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Astounding SCIENCE FICTION

MARCH 1947
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THE EQUALIZER

BY JACK WILLIAMSON

Reg. U. S. Pat. Off.

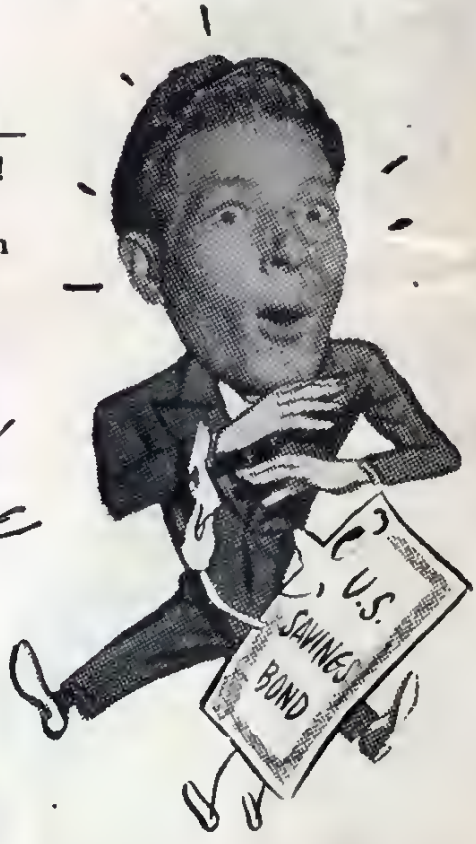
How to Avoid Saving Money

by DANNY KAYE

First, cut off all your pockets. By carrying your money in your hand you will—1. spend it, 2. lose it, 3. get it taken from you—*quicker!* Also avoid piggy banks and sugar bowls. The kiddies are victimized by such devices, often saving quite a bale of moolah. And shun budgets! Just buy anything you don't particularly hate.

Above all, don't buy any U. S. Savings Bonds—for, if you do, it's *impossible* not to save money! These gilt-edged documents pay fat interest—4 dollars for 3 after only 10 years! There is even an insidiously easy scheme called the Payroll Savings Plan by which you buy bonds *automatically*. Keep it up and you may even find yourself embarrassed by a regular income!

Danny Kaye



SAVE THE EASY WAY...
BUY YOUR BONDS
THROUGH PAYROLL SAVINGS

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Astounding SCIENCE FICTION

Reg. U. S. Pat. Off.

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JOHN W. CAMPBELL, JR

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AST—1P

STRUCTURAL METAL

There are now ninety-six known elements, six of them strictly synthetic, never found in nature, and another half dozen as stable in nature as a waterfall. The four superheavy elements—neptunium, 93, plutonium, 94, americium, 95 and curium, 96—have been made by different types of bombardment of uranium, 92. Two of the elements well down in the table—Nos. 43 and 61—have no stable isotopes whatever, and so do not exist in nature. The series of elements above bismuth which do occur in nature—polonium and up—are all structures having no stable isotopes. But uranium-238 and thorium-232 have such exceedingly long half-lives, all the other unstable elements derive from them continuously, waterfall fashion.

Of the stable elements, about half are metals, or semimetals. Their properties vary fantastically; cesium is so soft it can be molded in the fingers—and will melt in the palm of the hand if you have a bit of a fever. Lithium floats on water. Osmium is twenty-two times as heavy as water. But of all the metallic elements, only one will resist all known corrosive agents.

Osmium is normally found in nuggets of mixed alloy of osmium, iridium and platinum. When such nuggets were first studied by chemists, they presented one of the all-time highs in headaches for the analyst. Some of them, running ninety per cent or better iridium, could not be dissolved in aqua regia, chlorine water, or fused alkali, any one of which readily attacks platinum or gold. Iridium is immune to attack by anything going when in massive metallic state; in the form of a finely ground powder it can gradually be dissolved by fused sodium peroxide—which dissolves platinum like so much sugar. Iridium *really* is corrosion resistant.

We get used to thinking of this metal as being corrosion-proof, and that one being easily corroded, the other being mildly resistant, et cetera. Aside from the almost absolute resistance of iridium, any metal is rapidly and easily corroded away—under certain conditions. Fused sodium hydroxide eats platinum rapidly, it has no effect whatever on common iron. Highly resistant silver dissolves easily in nitric acid: aluminum is strongly resistant.

Man has, over many centuries, gradually added to his scant selection of structural metals. At first, only the metals which occurred as native, pure metals—gold, silver and copper—were available. Then smelting added greatly to his available supply of copper, and added tin and zinc and lead to his known metals. The result was not only three new metals, but the development of bronze and brass. With the invention of iron smelting, steel was added—and there the list practically stopped for at least two thousand years.

Only recently have we added aluminum to the list of structural met-

als; molybdenum, manganese, tantalum, tungsten, chromium, vanadium, columbium, titanium, zirconium, cerium, uranium, beryllium and a few others have appeared as alloy ingredients, or as very special purpose small-scale use metals directly. (As tungsten lamp filaments.) Cobalt and nickel have become important semistructural-semialloy materials, but are practically never used directly as structural metals.

Copper, lead, zinc and tin, the original, earliest structural metals, are all in the semiprecious metals class today. They can be used only sparingly, for decorative, corrosion-resistance, or other special reasons. Copper, the high-conductivity metal, has its very widespread special use.

But for bulk uses of metals, we have, today, only two common structural metals; aluminum and iron. We know enough nuclear physics now to know that there will be no new ones discovered; we know enough of Earth's geology to know that there's mighty little chance of finding abundant deposits of some rare metal. We've got to look at the relative occurrence of elements in the Earth's crust to determine where we can get new structural metals—and we need new ones. Not only will a new structural metal be directly useful, but its alloys with presently available metals will be still more helpful.

The most common of all elements in the Earth's crust are oxygen and silicon. In the sea, hydrogen and oxygen lead. But immediately behind them come sodium, chlorine, and magnesium. Magnesium constitutes an inexhaustible resource; it has the strength needed for a fine structural metal, and in the war years it has made rapid progress toward its proper place.

It may at first glance seem unfortunate that all three available—that is, abundant—structural metals are so-called "corrodable" metals. But it should be kept in mind that only iridium is really corrosion proof. Iron and magnesium will resist alkalies that dissolve platinum; aluminum resists acids that dissolve silver and copper. Magnesium resists hydrofluoric acid that eats glass and quartz. And it is, in every case, the *surface* that must resist corrosion, not the strength-giving solid interior. A microscopically thin coating can supply the corrosion resistance.

Actually, the unfortunate fact is that we live in one of the most virulently corrosive media imaginable—water is the greatest solvent known to chemistry, and oxygen is second only to fluorine in chemical violence. Yet both aluminum and magnesium are proof against that combination, because each forms a water-and-oxygen proof adherent film of oxide. Given time, we may yet work out even more resistant aluminum and magnesium alloys.

And magnesium, as a third major structural metal, increases the available tools of structural engineers a full fifty per cent; a light, strong, tough, and inexhaustible resource from the sea.

We've been needing a third first-rank structural metal!

THE EDITOR.

THE EQUALIZER

BY JACK WILLIAMSON

***There** are two ways of overthrowing a dictatorship. One involves mighty weapons, mighty armies, and vast destruction. The other involves little weapons—*

Illustrated by Pat Davis.

I.

Interstellar Task Force One was Earthward bound, from twenty years at space. Operation Tyler was complete. We had circled Barstow's Dark Star, nearly a light-year from the Sun. The six enormous cruisers were burdened, now, with a precious and deadly cargo—on the frigid planets of the Dark Star we had toiled eight years, mining raw uranium, building atomic piles, filling the cadmium safety drums with terrible plutonium.

Jim Cameron and I, on the *Great Director,* spent the last months of our homeward flight in the ship's prison. Held on suspicion of mutinous conspiracy, we underwent that efficient, antiseptic SBI equivalent of torture—intensive interrogation. Our release, like the arrest, was stunningly unexpected.

"O.K., you guys." In the prison hospital, a bored guard shook us out of exhausted sleep. "Come alive, now. You're sprung. Better get yourselves cleaned up—'cause Hudd wants to see you."

He returned our clean laboratory whites, and unlocked the shower room. The prison barber shaved us. We signed a receipt for our personal belongings, and finally stumbled out of the soundproof cell block where I had expected to die. There were no explanations and no regrets — the Special Bureau of Investigation was not emotional.

An MP sergeant was waiting.

"Come along, you guys." He pointed his stick at the officers' elevator. "Mr. Hudd wants to see you."

"Surprising," murmured Cameron. "But lead on."

Mr. Julian Hudd was not an officer. He had no formal connection with either the SBI or the Atomic Service. He was merely a special secretary of the Squaredeal Machine. As such, however, he gave orders to the admiral-generals.

Hudd, the rumors said, was the illegitimate son of Director Tyler—and Tyler, the rumors added, had sent him out to the Dark Star because he was getting too dangerous at home. He had enlivened the flight, the envious rumors repeated, with a secret harem installed on his private deck.

The brisk MP herded us out of the elevator. Another guard patted us for weapons, and then let us through an armored door. Hudd's aide, an Atomic Service commander, greeted us with astonishing civility.

"Go in, gentlemen." He opened a chrome-and-mahogany door. "Mr. Hudd will see you at once."

Julian Hudd rose to receive us, in the huge mahogany-and-chrome office beyond. At fifty, he was still handsome, he still bore a shaggy, dark-haired magnificence. Yet the enormous animal vitality of his heavy frame was visibly failing. He was paunchy; his blue cheeks sagged into jowls; dark pouches hung under his bloodshot eyes.

"Jim! And Chad!" We were not his friends—a Squaredealer had no friends; but he made a fetish of informality. He shook our hands, and seated us, and offered the first cigars I had seen in many years. "How are you?"

Cameron's lean face turned sardonic.

"We have no scars or mutilations, thank you."

Hudd nodded, beaming as genially as if he hadn't heard the sarcasm. He sat behind his opulent desk, and began tapping its sleek top with a paperweight, a small gold bust of Tyler.

"You two men are pariahs." He kept his smile of bland good nature, but his voice became taut, violent. "Civilian scientists! Your own mutinous indiscretions got you into the cells of the SBI. Except for this present emergency, I should gladly let you rot there. Now, however, I'm going to let you exonerate yourselves—if you can."

The sagging, furrowed mask of his face gave me no hint about the nature or extent of this present emergency, and we had been incommunicado in the prison. By now, I thought, we must be near Earth. Perhaps, it occurred to me, he intended to take over the Directorate from Tyler or his heirs.

Hudd's gray, bloodshot eyes looked at me, disconcertingly.

"I know you, Chad Barstow." His fixed smile had no meaning, and his loud voice was a slashing denunciation. "Perhaps your own record is clean enough, but you are damned by a traitor's name."

I wanted to protest that my father had been no traitor, but a patriot. For Dr. Dane Barstow had been Secretary of Atomics, in Tyler's first cabinet — when Tyler was only President of the United States. He had organized the Atomic Service, from the old Army and the Navy, to defend democracy. When he learned Tyler's dreams of conquest and autocratic power, he angrily resigned. That was the beginning of his treason.

In political disgrace, my father returned to pure science. He went out, with his bride, to found Letronne Observatory on the Moon. They spent the war years there, and discovered the Dark Star — my father first inferred the existence of some massive nonluminous body from minute perturbations of Pluto's orbit, and my mother aided him in the long task of determining its position and parallax with infrared photography.

Eagerly, Dane Barstow planned a voyage of his own to the Dark Star —he wanted, no doubt, to escape the oppressive intellectual atmosphere of the Directorate. He spent two years designing an improved ion drive, and then tried to find aid to launch his expedition.

Tyler, meantime, had betrayed democracy and destroyed his rival dictators. From Americania, his splendid new capital, he domineered mankind. He was pouring billions into Fort America, on the Moon, to secure his uneasy Directorate. He was not interested in the advancement of science.

Curtly, Tyler refused to finance or even to approve the Dark Star Expedition. He wanted the ion drive, however — for the robot-guided atomic missiles of Fort America. My father quarreled with him, unwisely, and vanished into the labor camps of the SBI. My mother died, in the care of a Squaredeal doctor.

Though I was only a little child, there are some things I shall never forget. The sadness of my father's hollow-cheeked face, and the intense, electric vitality of his eyes. The futile efforts of my mother, to hide her fear and grief from me. The terror of the SBI, that haunted my sleep.

Five years old, I was taken into the Tyler Scouts.

Task Force One, which put to space three years later, was not the supreme scientific effort of my father's planning. The great expedition, as Jim Cameron once commented, was merely a moral equivalent of war.

"Dictators need an outside interest, to divert rebellion." A tall man, brown and spare, Cameron had looked thoughtfully at me across his little induction furnace — we were working together, in his shipboard laboratory. "War's the best thing— but Tyler had run out of enemies. That's why he had to conquer interstellar space."

I looked uneasily about for possi-

ble eavesdroppers, for such talk was not healthy.

"I wonder how it worked." Cameron gave me his likable, quizzical grin. "Since we failed to meet any interstellar enemies, the essential factor was missing — there was no common danger, to make oppression seem the lesser evil. Perhaps it failed!"

Our arrest must have come from such reckless remarks as that. Cameron had always been unwisely free of speech, and it turned out that one of our laboratory assistants had been a Squaredealer, reporting every unguarded word to the SBI.

Now, in that richly paneled office, Julian Hudd kept drumming nervously on his sleek mahogany desk. Through that bland and masklike smile, he watched me with red, troubled eyes.

Hoarsely, I answered him.

"I know my father was a traitor, Mr. Hudd." I had learned to utter those bitter words while I was still a child in the Tyler Scouts, for they had always been the great price of survival. "But I've been loyal," I protested. "The SBI have nothing on me."

"You're lucky, Barstow." His voice was flat and merciless. "One word of real evidence would have drummed you through the execution valve. Now, I'm giving you a chance to redeem your father's evil name."

Then he turned upon Jim Cameron, accusingly. And a sharp unease took hold of me, for Cameron had never been broken to mute obedience, as I had been. Now, emaciated and weary as he was from the prison, he still stood proud and straight. His fine blue eyes met Hudd's—sardonic, amused, and unafraid.

Jim Cameron had always been that way—meeting the iron might of regimented society with a cool, critical intelligence; yielding, sometimes, an ironic show of respect, but never really giving up his proud independence.

He had been my best friend, since we came aboard the *Great Director,* among the thousands of Tyler Scouts who were sent to provide youthful replacements for the crews. He was twelve, then, the leader of our troop. He found me lying on my bunk, sick with acceleration pressure, homesick, too, dazed and hopeless.

"Hello, scout." He put a friendly hand on my shoulder, and gave me his wry, invincible grin. "Let's you and I get our gear policed up for inspection."

We arranged our equipment. He sent me for a brush to sweep under our bunks. I showed him the toys in my pocket—three colored marbles, a broken gyroscope top, and a lead rocket bomb—and even let him see the contraband snapshot of my parents. We went to chow together. We were friends.

Now, under the provocation of Hudd's shaggy-browed, glaring vehemence, I was afraid that Cameron's stubborn self-respect would once again get the better of his judgment.

"As for you, Jim"— Hudd's blue-jowled smile was genial, still, but his voice was harsh and violent—"your record is bad. You were broken

from the Tyler Scouts, for insubordination. You were blackballed from the Machine, for doubtful loyalty. You were even rejected for the Atomic Service."

"That's true, Mr. Hudd." Cameron remained cool and aloof.

"Civilian scientist!" Hudd's red eyes glared through his mechanical smile. "The execution valve is waiting for you, Jim. Never forget that. I've saved your life a dozen times—just because you've been useful to me. Now I'm giving you a chance to earn one more reprieve. But the valve's still waiting, if you fail. Understand?"

"Perfectly," Cameron murmured. "What's the job, this time?"

It was back on the worlds of the Dark Star, that Jim Cameron had first proved himself a useful man. There, under endless night, glaciers of frozen methane and ammonia hid the uranium ores we sought. Cold, near the absolute zero, hampered all our operations—and plutonium-making is never exactly safe and simple.

But Jim Cameron, like my father, had the rare gift of scientific genius. He invented an exquisitely sensitive gamma ray detector, to locate the pitchblende veins beneath the glaciers. He designed much of the automatic equipment we used for the difficult processes of mining, pile operation, and refining.

Thus, he earned an uncertain stay of execution.

"What's the job?" he repeated, now.

"One question, first." Behind the immense, shining mahogany desk, Hudd sat ponderous and impassive. His big mouth still smiled, but his red eyes were narrowed and dangerous. "What's the truth about this so-called induction furnace?"

"That's easy, Mr. Hudd." Cameron's low voice seemed relieved. "The last year, until our arrest, we were running routine assays of our metallurgical specimens from the Dark Star system. I built that little furnace, for convenience in fusing samples."

"So?" Hudd forgot to smile. His heavy, mottled face stiffened into a bleak mask of ruthless purpose. "The SBI reports that your assays were only a blind, to cover your experiments with that furnace."

Hudd paused, but Cameron said nothing. He merely stood waiting, his lean face grave enough, but an alarming hint of impersonal amusement in his eyes. And Hudd went on:

"I believe it was a most peculiar furnace." Hudd's loud voice was harsh and scornful, savage with accusation. "The SBI reports show that it consumed no current. They show that it changed the metals fused in it—that buttons of pure iron, on spectrographic analysis, began to show the yellow sodium lines."

Hudd's great body heaved forward against the desk, ominously.

"What about that?"

Cameron nodded easily. Then fear dropped like a staggering burden upon me. For he grinned across the gleaming mahogany, and told Hudd more than he had ever admit-

ted to the SBI, in all our months of intensive interrogation.

"I was looking for something," he said.

For a moment, as he spoke, Cameron let down the shield of reserved and sardonic amusement that he carried against a world of totalitarian compulsion. For a moment his voice had a hard elation, terrible in its honesty.

"I was looking for — freedom." His thin shoulders lifted, almost defiantly. "I thought I had found a new and simple technique for manipulating the cosmic stuff that sometimes we call matter and sometimes energy. I thought I had found the way out of the Atomic Age."

His blue and deep-set eyes, for just that moment, held a stern radiance. Then his brief elation flowed away. His tall, emaciated frame bent to a burden of failure, and I saw the gray sickness of the prison on his haggard face.

"I was mistaken." His voice went flat, with the dull admission of defeat. "The accidental contamination of pure specimens with spectroscopic traces of sodium is notoriously easy. I had already abandoned the experiment, before we were arrested."

Hudd nodded his great shaggy head, unsurprised.

"You're smart to tell the truth—and lucky that you failed." His broad, blue-jowled face recovered its habitual political smile. "Now, I think you've had a lesson, Jim, and I'm going to give you another chance." His voice turned savage again. "I don't mean another chance at treason — for you'll be watched, every minute."

Erect again, Cameron stood waiting. The defeated look was gone. His lean face was properly grave, but his keen blue eyes had a glint of amused yet somewhat saturnine expectancy.

"What's your trouble, Mr. Hudd?"

Hudd pushed the little golden head of Tyler away from him, across the opulent desk. Ponderously shifting his great bulk, he leaned back in his wide chair, knitting his fingers so that his huge, black-haired hands cradled his paunch. Under the dark thick brows, his small eyes were red with fatigue and trouble.

"I suppose you noticed when we went from acceleration thrust to centrifugal, three days ago?" His rasplike voice was nervous, now, dry and hurried. "Anyhow, we're back—on a temporary orbit twenty thousand miles from the Moon."

"And something's wrong?" Cameron's voice, it seemed to me, had some faint undertone of malicious anticipation. But Hudd didn't notice, for he stated, with an apprehensive gravity:

"Something has happened to the Directorate!"

"Eh?" Cameron's veiled amusement vanished. "What?"

"Here are the facts." Heavily, Hudd lurched forward against the desk again; his voice had a little snap. "We began calling Fort America weeks ago, from millions of miles at space. Our signals weren't answered. So far as we can de-

termine, the Moon has been abandoned."

His bloodshot eyes looked haunted.

"We haven't tried to signal the Earth — I want to keep the advantage of surprise, until we know the situation. But things have happened, even there."

He reached, with a huge and hairy paw, for the little golden bust of Tyler, and resumed his nervous drumming.

"But we've been listening, on every possible wave band. Of course, out here, we couldn't expect to get much. But we are in range of the great television propaganda stations of the Applied Semantics Authority —and they are dead. All we have picked up are feeble clicks and squeals—scrambled radiophone signals, apparently, which the engineers have failed to unscramble."

His lowered voice echoed a baffled unease.

"The telescopes give us several puzzling hints," he went on soberly. "The forests have grown, since we left — the spread of green into the deserts might almost indicate a general climatic change. The haze of smoke is gone from the old industrial areas. Where several cities used to be, in the tropics, we can find only green jungle."

"Very interesting," Cameron murmured gently.

"Two landing parties were sent to Earth in lifecraft," Hudd plowed grimly on. "One was to land in Europe and the other in North America. Nothing has been heard from either, since they entered the ionosphere. They are twenty-four hours overdue."

The solemn, baffled hush of his voice gave me an uncomfortable chill of strange mystery. It would be a terrible and ironic thing I thought, if we had come back from our long exile to find our own humankind somehow vanished—but of course that couldn't be.

Hudd blinked at Cameron, with shrewd weary eyes.

"Now, I'm sending out another party." His loud voice turned crisp and decisive. "Captain Rory Doyle will be in command—under the advice of my liaison man, of course—and Doyle wants you two with him. You are taking off in two hours. Your first objective is to learn what happened to Fort America."

Hudd put his great hands flat on the desk, and came laboriously to his feet, puffing with the effort. For all his gross bulk, however, he made a towering figure, dynamic and impressive still. Shrewd and imperious, his small eyes flashed from Cameron to me, and back again.

"You had better find out." His rasping voice turned violent. "Your mission is important. I believe the Directorate has been overthrown, and I intend to restore it. I've got plutonium enough to smash half the Earth. The first necessity, however, is to learn what has happened. I believe you can anticipate the consequence to yourselves of failure."

"I think we can, Mr. Hudd," said Cameron.

My heart began to thump, with an excited and somewhat apprehensive expectation.

II.

Lifecraft 18 was a trim steel missile, lying snug in its berth tube amidships of the *Great Director.* Eighty feet long and slim as a pencil, it had its own ion drive, a regular crew of six, and plenty of additional space for our party.

Captain Rory Doyle met us at the valves. He was a big man, red-haired, straight and handsome in the gray of the Atomic Service. We knew him, for we had been with him on several prospecting flights to the planets of the Dark Star. He was capable, fearless, and loyal to the Directorate. With a tanned, open smile, he welcomed us aboard his swift little craft.

His crew of able spacemen helped us stow our space armor, and the rest of our hastily requisitioned equipment. Our takeoff time went by, but Doyle scowled at his wrist chronometer and kept the valves open.

"Waiting for Victor Lord," he muttered, "the Squaredealer."

Only his impatient tone suggested any dislike for Squaredealers—and even that was indiscreet.

Lord came swaggering insolently aboard, twenty minutes late. He was a tiny man, very erect and precise in his gray uniform—with the gold squares of the Machine instead of the Atomic Service insignia. He had tight brown skin over a hard, narrow face, and heavy, sleepy lids drooping over pale yellow eyes. His long black hair had a varnished slickness. Strutting between his two tall, black-clad SBI bodyguards, he looked like a peevish dwarf.

He didn't bother to return Doyle's correct salute.

"You know my status, Doyle." His high, nasal voice was deliberately overbearing. "My duty here is to oversee your performance of this important mission. We'll have no trouble—if you just keep in mind that my report can break you."

He paused to blink at Doyle, with a sleepy-lidded, supercilious arrogance. Success in the Squaredeal Machine required a ruthless, cunning brutality; and Lord, I knew, stood second only to Julian Hudd. Haughtily, he added:

"You may take off, now."

"Yes, Mr. Lord," Doyle said stiffly.

The Squaredealer's petulant insolence may have been nothing more than a compensation for his insignificant size, but still I didn't like him. His yellow eyes were shifty and suspicious; his narrow forehead sloped and his nose was too big; his whole expression was one of alert and vicious cunning.

Doyle turned away quickly, perhaps to conceal his own resentment. He ordered the valves closed, and climbed the central ladder well to his bridge. A warning horn beeped, a few minutes later, and we cast off.

In the acceleration lounge, we hung weightless for a few seconds, as we dropped away from the flagship; then the thrust of our own ion drive forced us back into the cushions, with a two-gravity acceleration.

I turned, in the padded, reclining seat, to look back through a small

observation port. Against the dead black of space, I glimpsed the enormous bright projectile shapes of the *Great Director* and the *Valley Forge* —coupled nose-to-nose with a long cable, and spinning slowly, like a tiny binary star, to create a comfortable centrifugal force.

Earth, seemingly close beside them, was a huge ball of misty wonder. The twilight zone made a long crimson slash, between the day-side and the night. Dull greens and browns and blues were all patched with the dazzling white of storms.

All the hope and longing of twenty years burst over me, when I saw the Earth, in a sudden flood of choking emotion. My wet eyes blurred that splendid view. I sat grappling in vain with the monstrous and shocking mystery of spreading forests, jungle-buried cities, and unintelligible radio clicks and squeals, until Lord's high nasal voice recalled me to the lifecraft.

"Civilians, huh?" Sitting pygmy-like between his two husky guards, Lord turned condescendingly to Cameron. "But Mr. Hudd insisted you must come, so let's have your expert opinion."

He stressed the adjective too strongly, but Cameron answered quietly: "I rather expect we'll find the ultimate result of what the old economists used to call the division of labor."

At the time, I failed to see the real significance of the interchange that followed, though it proved the key to much that happened later. I was merely annoyed at Cameron, and somewhat alarmed, because his talk plainly angered Lord.

"Explain!" Lord rapped, imperiously.

"If you like — though I'm afraid the historical principle runs counter to Squaredeal ideology." Cameron was a little too grave. "Because I don't believe the Directorate was created by Tyler's unique statesmanship, or even by the emergent dictatorship of the little man. It was, I think, just one of the end-products of the division of labor."

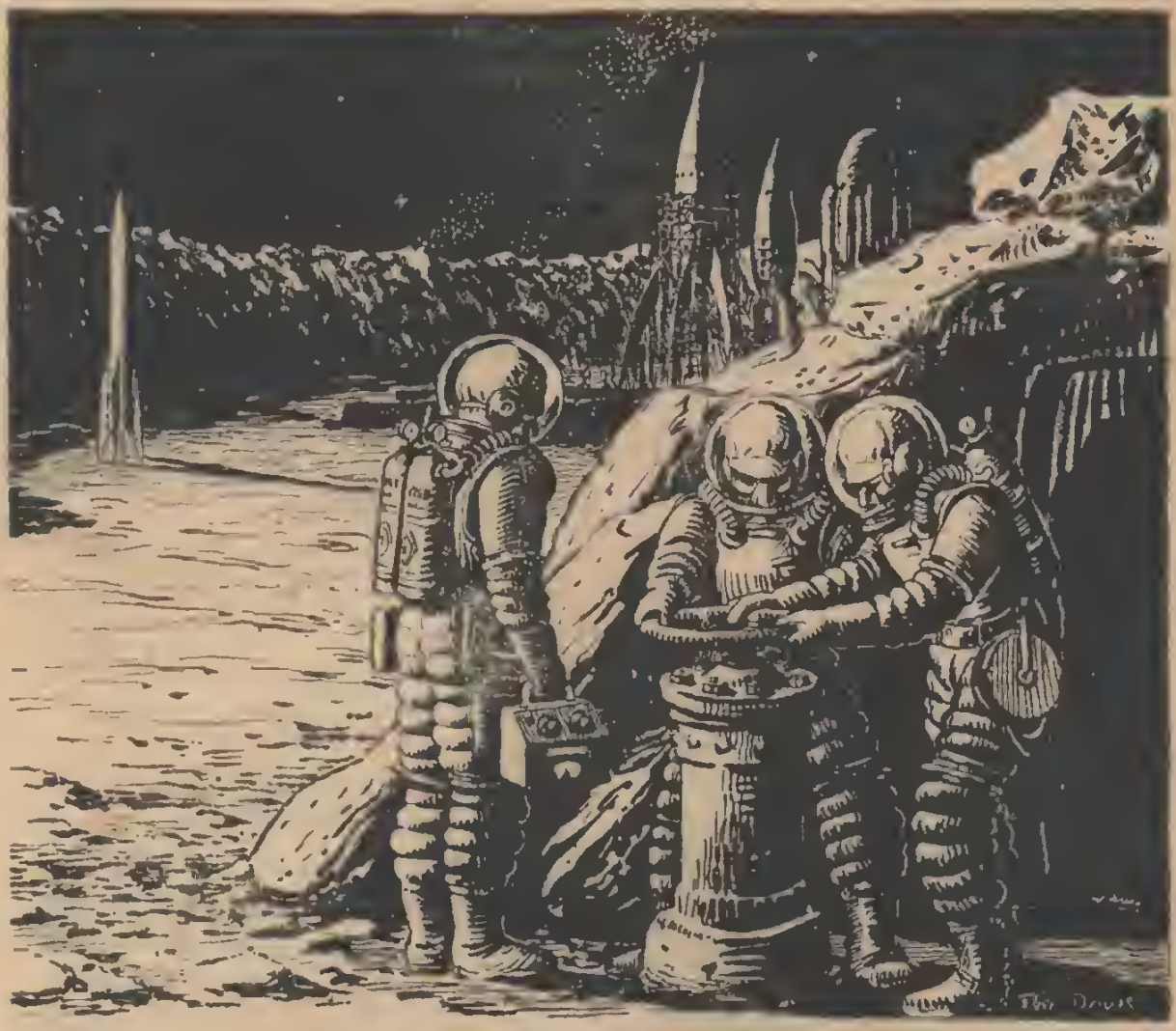
Lord blinked his heavy-lidded eyes, apparently uncertain whether this was double-talk or high treason. I kicked Cameron's foot, in a vain effort to suggest the wisdom of discretion.

"Explain yourself," Lord commanded sharply.

"Nothing to it," Cameron said easily. "The division of labor was hailed as something wonderful—before its unpleasant final consequences came to light. One man made arrows, another hunted, and they both had more to eat. That was very fine, back in the Stone Age."

Cameron stretched out his legs, cheerful and relaxed.

"But it went a little farther, in the modern world. Division of labor divided mankind, and set special interests against the common good. It made specialists in mining coal, in scientific research, and even in political power, Mr. Lord. The specialists formed pressure groups, and fought to advance their own class interests—with weapons incidentally created by that same division of labor.



"When specialists fight, the winners are apt to be the experts in war," he continued brightly. "Thus government becomes a function of military technology, which of course derives from the basic industrial technology. The prevailing form of government, therefore—dictatorship or democracy—depends on the current status of the division of labor. That interesting relation of technology and politics was pointed out by the old philosopher, Silas McKinley."

Lord's sleepy eyes glitered suspiciously.

"He's forbidden! Where do you keep such pernicious literature?"

Cameron grinned, quizzically. "Once I had permission to do some research in Mr. Hudd's very excellent library."

"And you're apt to suffer for the dangerous ideas you acquired there," Lord commented acidly. "Now what's this nonsense, about technology and government?"

"Political power reflects military power," Cameron cheerfully explained. "When war is fought with cheap, simple weapons, easy for the amateur to use, then the military importance of the ordinary citizen is reflected in his political freedom.

Democracy in America was established by the flintlock, and maintained by Colt's revolver.

"But democracy is always threatened by any increase in specialization, especially military specialization. When weapons are expensive and complicated, requiring a class of military experts, then the ordinary man can't defend his rights—and he therefore has no rights.

"Democracy was murdered, on a desert in New Mexico, in 1945. Already, for a hundred years, the increasing division of labor had been forcing it into a slow decline. The same specialization that created the bomber and the tank had already reduced the free citizen to a pathetic little man, at the mercy of the corporation manager, the union leader, and the bureaucrat.

"The atom bomb was the finish, to freedom. Because it was the final limit, to specialization. The most complicated and costly weapon, ever, its production and use required a fantastically complex division of labor. Politics had to follow the trend of technology, and totalitarian control destroyed the individual."

Sitting half upright in the long reclining chair, Cameron gave the little Squaredealer his wry, sardonic grin.

"Tyler thought he had conquered the world," he concluded. "But really it was just division of labor that created the new technology of atomic war, and so destroyed the whole world's freedom. It was just the trend of specialization that made the Directorate and flung Tyler to the top of it — no more responsible than a pebble flung up by a wave."

Pressed deep in the cushions, Lord sat peering back with confused suspicion in his yellow, heavy-lidded eyes. Fortunately for Cameron, he was now concerned with dangers more immediate than ideological heresy. His nasal voice rasped angrily:

"Well? What happened—according to your theory?"

Cameron answered his sharpness with an easy grin.

"Quite likely, the division of labor broke down at last."

"Watch your manner, mister." Lord didn't like his cool grin. "What could break it down?"

"Rebellion, perhaps." Cameron was properly respectful. "Fort America had a permanent garrison of nine thousand specialists in death. They were prepared to devastate any part of the Earth—or all of it. Perhaps they were just too thorough."

Uneasily, the little Squaredealer licked his thin lips.

"Then why should the fort itself be silent?"

"Disease, perhaps—some biological agent out of control." In Cameron's blue eyes, I caught a faint glint of malicious amusement. "Or famine — maybe they left the Earth unable to feed them. Or cataclysm."

Lord fought the acceleration pressure, to sit bolt upright. His bleak narrow face was filmed with sweat of effort—and of fear.

"Cataclysm?" He peered into Cameron's lean, sardonic face. Explain!"

"Twenty years at space has shown us the insensate hostility of the

universe." Now low and solemn, Cameron's voice deepened my own unease. "Man lives at the mercy of blind chance, surviving only through a peculiar combination of improbable factors. Just suppose we find the Earth stripped of oxygen." He grinned at Lord, satanically. "As efficiently as the planets of the Dark Star were robbed of uranium?"

Before we reached the Moon, Lord had turned a sallow green with acceleration sickness.

Fort America was hidden beneath a crater in the tawny, riddled desolation of the Mare Nubium. We wheeled above the mountain ring, just above the highest crags, searing the dozen miles of barren floor.

"It hasn't changed!" I whispered to Cameron. "The valves, the roads, the docks—just as they used to be!" I tried to point, through the small quartz port. "There's where the *Great Director* stood."

"But it has changed." Cameron glanced at me, and the strong glare of the moonscape, striking his haggard face from below, made his habitual sardonic expression seem oddly diabolic. "It's abandoned, now."

And I remembered. Great trucks once had rolled over that white web of roads. Colored signal lights had blinked and flickered from the domes over the pits. Tall, tapered ships had stood like rows of silver pillars on the dark, wide fields.

But now the crater was an empty bowl. The lowering sun made all the westward rim a jagged lip of shattered ebony. Sharp fingers of the dark crept across the empty hollow, to clutch the empty domes and seize the empty roads.

Nothing moved, anywhere. No metal flashed, beneath the sun. No signals flickered, now, out of the cold, increasing shadow. Men had been here once, armed with atomic science, bold with conquest. Now they were gone.

Yet the crater wasn't empty, quite—for it held a riddle. What had silenced man's greatest citadel? Cold dread sank into me, out of that black, expanding shadow. The brooding mystery of it seemed to numb my senses, like some deadly biotoxin.

We landed at last, well out in the retreating sunlight, on a concrete road near one of the valves. We clambered into space armor—Cameron and I, and Captain Doyle. Laden with assorted equipment, we scrambled one by one through the small air lock, and leaped clumsily down to the Moon.

Victor Lord remained aboard. He was ill. I believe his apprehensive thoughts had fastened too strongly on Cameron's malicious suggestion of interstellar invasion. I think he expected us to encounter unearthly monsters lurking in the pits and tunnels.

Beside the bright spire of the lifecraft, we set up a portable Geiger-Müller counter, and a neutron detector. The counter started flashing rapidly, and I couldn't stop an apprehensive gesture toward the valves.

"Dangerous intensity!" My voice rang loud and strange in the spherical helmet. "The residue, maybe,

from atomic weapons — though I don't see any craters."

But Cameron was shaking his head, which looked queerly magnified inside the thick, laminated bubble of his helmet.

"Just the normal secondary activity, excited by our own ion blast." His voice came on the microwave phone, dulled and distorted. "I think it's safe for us to go on."

Moving clumsily with all our equipment, we left the tiny craft a hundred yards behind, and tried again. There the counter showed only the normal bombardment of the unfiltered solar and cosmic rays.

"Come along!" Doyle's deep voice roared in my phones. "Have a look —here's a whole row of wrecks. The mutineers must have caught them sitting. They're blown all to scrap!"

Beside a huge deserted dock of gray pumice-concrete, he had discovered the dismembered remnants of half a dozen vessels. We approached cautiously, and paused again to test for dangerous radiations. There were none — for these skeletons of spacecraft had been stripped by something else than mutiny.

This had been a repair dock. Doyle pointed sheepishly at abandoned cranes, and empty jet pits. The apparent wrecks had merely been cannibalized—their plates and valves and jets ripped out, to repair other vessels.

"No mutiny!" Doyle made a disgusted sound. "Let's look below."

For the actual fort was far beneath the crater. A vast web of tunnels sheltered hangars, shops, barracks, and magazines. The launching tubes, trained forever on the Earth, were hidden in deep pits. Somewhere in that sublunar labyrinth, we could hope to find our riddle answered.

The nearest entrance shaft was topped with a low dome of concrete, piled with pumice boulders by way of camouflage. The great armored valve was closed, unrusted, quite intact. Doyle spun a bright little wheel outside.

"I was stationed here, before they picked me for the Task Force," he said. "A robot-missiles officer—used to know my way around."

The massive steel wedge failed to move, and Doyle turned to another, larger wheel. It resisted, and I came to help. Stubbornly, it yielded. The great wedge sank slowly.

"Power's off." Doyle was breathless with effort. "Manual emergency control!"

We shuffled at last into the huge dark chamber of the lock. Our battery lights cast flickering, fantastic shadows. Doyle studied a row of dials and gauges on the curved steel wall, and punched a series of buttons.

Suddenly I felt a faint vibration. The huge wedge lifted behind us, shutting out the dark and harsh-lit moonscape. The chamber was a steel-jawed trap. I felt a tense unease, and the sudden boom of Doyle's voice startled me.

"The main power lines are dead. That's an emergency generator, with a chemical engine — there's one at each valve, to work the controls and energize the instruments." He

scanned the dials again. "Shows air, inside—twelve pounds. We'll have to test it."

He turned another wheel, and air screamed into the chamber. It brought back sound — the clink of our equipment, the clatter of our armored boots, the throb of the emergency engine beneath the metal deck.

We tested it. The counter gave only an occasional click and flash. I broke the glass nipple off a regulation testing tube, and Cameron leaned clumsily beside me to study the reaction of the colored paper indicators.

"O.K.," he said. "Safe."

We took off our armor. The air was fresh, but icy cold—we exhaled white mist. Hopefully, Doyle tried the telephone in the box beneath the dials. Dead silence answered him. Shivering perhaps to a sense of something colder than the freezing air—he hung it up and opened the inner valve. The emergency power system didn't work the elevators. We climbed down a black ladder well, into the silent citadel.

III.

Fort America was dead.

The thrumming of the little emergency engine was muffled, as we climbed on down, and finally lost. We descended into appalling silence. So long as we moved, there was a comfortable rustle and clatter. When we stopped to listen, there was nothing at all.

Everywhere, the power lines were dead; the lights were out. Midnight shadows retreated grudgingly from our little battery lamps, and lay in wait at every turning. Beyond was total dark.

The heating system must have been shut off long ago, for the cold was numbing. Sweat had dampened my wool lined suit, in the heated armor, and now it was icy on my back. The chill of the rungs sank through my thin gloves; my fingers were stiff and aching, long before we reached a horizontal passage.

Gruesome expectations haunted me. I looked for frozen corpses, twisted with the agony of some biotoxin, or charred with atomic heat. Queerly, however, we found no mark of violence, nor any evidence of human death.

"They're just—*gone!*" Even the deep voice of Captain Doyle held a certain huskiness of dread. "Why —I can't imagine. Nothing wrong, no sign of any trouble." He caught his breath, squared his shoulders. "We've got to find the answer. Let's try the commandant's office."

He led the way along a black and soundless lateral tunnel, and opened an unlocked door. The series of rooms beyond was deserted — and quite in order. Empty chairs were neatly set behind the empty desks. Dead telephones were neatly racked in their cradles. Pens in their stands were neatly centered on green blotters, with the ink dried up.

Doyle rubbed a dark mark in thin gray dust.

"They've been gone a long time." His voice seemed oddly hushed; yet it was too loud in those silent rooms.

I began to open the drawers of desks and filing cabinets. They were

all empty. The bulletin boards had been stripped, the floors swept clean. Even the wastebaskets had been neatly emptied.

A large portrait of Tyler, in the commandant's office, had slipped askew on the walls. Doyle moved without thinking to set it properly straight. Cameron followed the movement, I noticed, with a curious sardonic expression, but he said nothing.

"The evacuation must have been quite orderly." Doyle shook his head, his eyes dark with bewilderment. "No sign of haste or panic. Now what could have caused them to go?"

We moved on, in search of the answer.

It wasn't famine. We walked through an empty mess hall. The long tables were all in line, filmed with fine gray dust. Clean trays and silver lay in geometric order, where the last KP's had left them, for the last inspection. The warehouse beyond was stacked high with crates and bags and cans of food, frozen now, and still preserved.

Nor was it any biological killer, gone wild. We found hundreds of beds in a hospital tunnel, empty, their dusty sheets still neat and smooth. The pharmacy shelves were loaded with drugs, untouched.

"Power failure?" Cameron suggested. "If the pile had gone dead—"

Rory Doyle found the way, down a black and bottomless ladder well, to the main power pile. The massive concrete safety wall shut us away from all the actual mechanism, but Cameron scanned the long banks of recording instruments and remote controls. He flashed his light on a distant conveyer belt, motionless, loaded with bright aluminum cans.

"Nothing wrong," he said. "The last operator discharged the pile—dumped the canned uranium out of the lattice, into the processing canyon underneath. There's plenty of metal left, but it wasn't charged again."

On another black and silent passage, a little above, we came to the steel-walled dungeons of the guardhouse and the military prison. The armored doors stood open. The records had been removed. The prisoners were gone.

"Revolt, perhaps," Doyle suggested. "Perhaps the prisoners escaped, and touched off a mutiny in the garrison — no, that couldn't have been, or we'd see the marks of fighting. But perhaps it was revolution, on Earth. That explains everything—if the missiles are used up."

He led us up again, along an endless silent tunnel, and down another dark ladder well. We spun stiff wheels to open three heavy safety doors, and came at last into one of the magazines.

Doyle gasped, in blank astonishment.

For on row, as far as our lights could reach, long racks were loaded with the robot missiles. They were sleek cylinders of bright metal, gracefully tapered, every part of them beautiful with precise machining. Spaceships, really, they were six feet thick and sixty long, each powered with its own light pile, driven with its own ion-jets, con-

trolled with the fine and costly mechanism of its own robot pilot, each burdened with its own terrible cargo of plutonium or crystalline biotoxins.

Stunned, almost, Doyle walked to the nearest. He examined it expertly, lifting inspection plates, flashing his light on serial numbers. He came slowly back to us, baffled.

"All abandoned!" he muttered. "I can't believe it. Why, those babies cost three million apiece, even in mass production. They are loaded with the finest precision machines that men ever made. They take off at twenty gravities. Just one of them, in forty minutes, could obliterate any city on Earth. And never a one was fired!"

We climbed again, up a black narrow shaft, to the launcher which Doyle had once commanded. Bright, satiny metal shimmered against our lights. The huge vertical barrel cast monstrous, leaping shadows. Doyle slipped into a familiar seat, and touched familiar buttons. An emergency engine began drumming. A huge periscope lens was suddenly bright with the broad crescent Earth —with thin black crosshairs intersecting upon it.

He flashed his light on a blank log sheet, and shook his head.

"It was never fired."

Cameron was whistling through his teeth—a gay bit of melody that made a grotesque counterpoint to the themes of lifeless quiet and ghastly dark and deadly cold, and the whole inexplicable riddle of the abandoned fortress.

"Are these weapons still serviceable?" he asked.

"Not without some missing parts." Doyle opened an inspection door, to show a dark cavity. "The computer has been removed, and the gyros are gone from the projectiles."

"Too bad." Cameron's voice held the hint of irony. "I imagine Mr. Hudd is going to need them."

"They can be repaired," Doyle assured him soberly. "Our spares for the ships' launchers are interchangeable." And Doyle looked at his chronometer. "Now it's time to report to Mr. Hudd—that our mission has failed."

The stern simplicity of the lifecraft, when we were safely back aboard, seemed luxurious. We relaxed in the acceleration chairs; gulped hot soup against the chill of those abandoned tunnels, that lingered in our bones; and answered the peevish questions of Victor Lord.

The signal officer soon reported that he had contact with the *Great Director*, and we crowded into the narrow television signal room. Hudd's heavy, blue-wattled face filled the big screen; the habitual smile of his thick lips failed to cover his anxious and weary concern.

"Let's have it, Jim." His loud, hearty voice was edged with tension. "What happened to the fort?"

"Evacuated, Mr. Hudd."

"But why?"

"We failed to discover that," Cameron reported. "The withdrawal was deliberate and orderly. The records were mostly removed or destroyed; the weapons were disabled without unnecessary destruction; the men took their personal belongings.

There's no evidence whatever of trouble or violence."

"When did it happen?"

"About two years, I think, after the Task Force left. The dates on calendar pads and inspection cards show that men were here that long. The lowered air pressure, the accumulated dust, and the low counter readings we got about the main power pile, all show that they weren't here much longer."

Hudd turned, on the screen, to rap a few questions at Doyle and Lord. Lord's uneasy insolence had changed to a silky deference, now. He explained that acceleration sickness had kept him on the life-craft.

"A very puzzling situation." Hudd's hushed voice and his frown showed his bewildered apprehension. "The entire Task Force, I feel, is in danger, until we find out what has happened."

He straightened, on the screen, and his voice took on a confident authority.

"Captain Doyle, you will proceed at once to Earth. You will land at Americania. Discover what happened to the Directorate—and what enemies we must destroy, to restore it. Take any precautions that you think necessary. But this time you must not fail."

"Yes, Mr. Hudd."

Hudd answered his smart salute, and turned on the screen.

"And you, Mr. Lord, had better get well."

IV.

Our lifecraft, next day, spiraled slowly down over Americania—the splendid capital city which Tyler had founded, sentimentally, upon the poor, rocky farm where he was born. Peering down through the ports, we felt an increasing sense of fearful puzzlement.

Wide suburban areas had been devastated by explosion or fire, so long ago that lush green forest had now overspread the blackened, broken walls and the twisted frames of rust-red steel—but most of the city looked quite intact.

Avenue upon avenue, proud towers stood like monolithic memorials to history's greatest empire. Tyler—with what now seemed an excessive confidence—had ordered his architects to build for a thousand years. Americania was a city of granite—of gray colossal masses, pillared and towered with contrasting red granite, and purple, and black.

Far below us, those stately avenues looked strangely empty, now. Nothing moved. Tall stacks rose from power plants and industrial buildings, in the green-choked suburbs, but there was no smoke.

Was Americania all abandoned, like the Moon?

Fear of that sent an uncomfortable prickling up my spine. I looked hopefully at my companions. Little Victor Lord had turned a sallow gray, and sweat made dark blots through his shirt. His two SBI men, in their ominous black, had turned away from the ports; they muttered together uneasily, and checked the action of their automatics.

Jim Cameron turned from his port, whistling in a way he had, softly through his teeth. The air

was the light, lilting melody of an old love song. The dwarfish Squaredealer whirled on him, in a sudden, tight-lipped fury.

"Stop your impudent whistling!" Lord's wrath had its real origin, no doubt, in his own frightened bafflement, but his heavy-lidded eyes looked dangerous. Even after Cameron stopped the whistling and turned back to the port, still he wasn't appeased.

"Look at me, you smart civilian!" Lord's sharp nasal voice was angrily insolent. "Frankly, I don't approve the confidence that Mr. Hudd has placed in you. Now I'm warning you—watch your step!"

His small quick hand hovered suggestively over the heavy automatic that sagged at his hip.

"Whatever we find here," he snarled, "my duty is to assure your continued loyalty to the Squaredeal Machine. Whatever happens, just remember that."

"I'll keep it in mind, Mr. Lord," Cameron promised him evenly.

Captain Doyle set the lifecraft down at last on Tyler Field — the immense spaceport on the outskirts of the city. Once it had been the gateway to the planets. I could remember my childish awe at the rush and glitter and vastness of it, from twenty years ago—when we marched across it, bravely screeching out the Tyler Song, on our way out to Fort America and the Dark Star. Now, when I saw it again through the small ports of the lifecraft, the change made me almost ill.

Like Fort America, the spaceport seemed abandoned. Here, however, weather and decay had kept at work. Green life had kept on, overflowing every plot of soil, bursting from every crack in the neglected pavements, after all men were gone.

Long rows of shops and warehouses stood deserted. Doors yawned open. Neglected roofs were sagging. Ruined walls, here and there, were black from old fire. Every building was hedged with weeds and brush.

Far across the shattered pavements stood the saddest sight of all. A score of tall ships stood scattered across the blast aprons, where they had landed. Though small by comparison with such enormous interstellar cruisers as the *Great Director*, some of them towered many hundred feet above the broken concrete and the weeds. They stood like strange cenotaphs to the dead Directorate.

Once they had been proud vessels. They had carried the men and the metal to build Fort America. They had transported labor battalions to Mars, dived under the clouds of Venus, explored the cold moons of Jupiter and Saturn. They had been the long arm and the mighty fist of Tyler's Directorate, and the iron heel upon the prostrate race of man.

Now they stood in clumps of weeds, pointing out at the empty sky they once had ruled. Red wounds marred their sleek skins, where here and there some small meteoric particle must have scratched the mirror-bright polish, letting steel go to rust. And the rust, in the rains of many years, had washed in long, ugly,

crimson streaks down their shining sides.

One of them, the most distant, had fallen. The great hull was flattened from the impact, broken in two. Steel beams, forced through the red-stained skin, jutted like red broken bones. The apron was shattered beneath it, so that a thick jungle of brush and young trees had grown up all around it.

Captain Rory Doyle came silently down his ladder from the bridge. His square face was black with gloomy puzzlement — as any loyal spaceman's should have been.

"A graveyard," he muttered, "of fine old ships—my first training voyage to Mars was on the old *Paul Jones,* yonder." He turned sadly to us. "Gadgets ready, Mr. Cameron? Then let's go out and see what unholy thing has happened to them."

"Hold on, Doyle!" Lord's nasal voice was sharp with dread. "Shouldn't we test the air? Suppose something has happened to the atmosphere?"

Doyle turned to Cameron, red brows lifted.

"I don't think it's necessary, Mr. Lord," Cameron said respectfully. "You can see a gray squirrel scolding at us from the tree growing out of the apron, yonder, and a buzzard circling, toward the city. I think the air's all right."

"I'll do the thinking." The little Squaredealer drew himself up stiffly, in the sweat-blotched uniform. "Test it."

I found a test flask, and took it down to draw a sample through a tube in the inner valve. Cameron watchfully checked my reading of the colored indicators, and the counter.

"It's safe enough, Mr. Lord," he reported crisply. "Oxygen normal. A bit of secondary radioactivity—due to our jets. No detectable military toxins, chemical, biological, or radiological."

"Then we're going out." Doyle looked thoughtfully at Cameron and me. "I don't know what we're running into. If you wish, I'll issue you arms."

"No, you won't!" The little Squaredealer barked the sharp protest. "These men are suspected mutineers, Doyle. I'll take no chances with them."

Doyle's square jaw slowly hardened.

"Mr. Lord," he began, "I believe the SBI found nothing—"

"It doesn't matter, captain, Cameron broke in. "We've gadgets enough to carry. Anyhow, I doubt that a pistol would be much use, where Fort America failed."

Lord looked at him, with a puzzled alarm in his sleepy-seeming eyes, and then muttered something to his two gunmen. Their uneasy eyes went to Cameron.

Doyle led the way down the ladder well. Air hissed, and the valves clanged open. One by one, we stooped to follow him through the lock, and jumped out between the shining stabilizers to Earth.

We hurried away from the scorched concrete and smoking weeds about the little ship, where the ion-jet might have excited a dan-

gerous secondary activity, and then stopped to catch our breath.

Earth! We had dreamed of it, for twenty years. Here in the northern hemisphere, it was early summer; the sky was a wondrous milky blue, flecked with cottony cumulus The forenoon sun struck with a hot, welcome force. The warm air was heady with a fragrance that stirred old memories—the rich strong smell of green life growing out of damp vegetal decay. I heard a heavy buzzing, half-remembered, and saw a bumblebee.

The warm Earth, alive — and a lone black bird, yonder, wheeling over an empty city.

Lord, running after us through the blackened weeds, let out a nasal yelp of horror. A white skull, which he had stumbled against, rattled and bounded before him. We found the rest of the skeleton, with a rust-caked revolver on the broken concrete beside it. Scraping about in the weeds, we discovered several shapeless lumps of gold and blackened silver, and a bent penny that still showed Tyler's profile. Cameron found a handful of tarnished rings, several ruined watches, and a once-magnificent diamond bracelet with the links half-fused and the stones burned black. Doyle picked up a wicked-looking stainless steel blade, with its haft rotted away.

"A curious lot of loot." Cameron stood up, puzzled. "All burned, the money melted down. Maybe he was struck by lightning. Or maybe looting just wasn't cricket."

Lord stood off and fired a bullet into the skull, perhaps just to relieve his frightened tension. It shattered into white dust. He holstered the big automatic with an air of uneasy satisfaction, and mopped the sweat of his narrow sallow face, and followed us watchfully.

We went on to the nearest ship. The bright curving hull towered three hundred feet, marred with long vertical streaks of red rust. It was a stubby freighter; Doyle said it had been in the Martian metal trade.

We followed Doyle up a rusty accommodation ladder, into the lock. The inner valve was closed, stiff with rust. We strained and hammered at the manual wheels, until it groaned reluctantly open. A breath of stale air came out, and we stumbled through the lock, into dusty dark.

There was no power for lights or elevators. The interphone system was dead. We probed the silent dark with flashlights, and Doyle led the way up the ladder shaft beside the elevator. Lord, with his two gunmen, decided to remain below.

Doyle climbed into a cargo hold, and cursed softly, in breath-taken astonishment.

"Plutonium!" A bewildered awe hushed his voice. "Hundreds of tons of refined plutonium in cadmium drums — enough to blow up half America — worth hundreds of millions." His haunted eyes peered back at Cameron. "Why did they leave it?"

We climbed on, looking for the answer. Our feeble lights, as we passed, searched each dark compart-

ment. Everything was left in order. The galley was clean. The power pile was discharged and secured.

There were no other skeletons.

A hard climb brought us to the executive deck. We found dusty charts and orbit plots neatly folded, astrogation instruments safe in their racks. Doyle opened an unlocked safe, and uttered a shout of triumph.

"Now we'll know—here's the log."

He fumbled with the yellowing pages. Eagerly, we leaned to read the brief, routine entries which described an uneventful voyage from Mars. The four-hourly observations and computed positions were neatly entered, and the hourly checks of apparent solar position and diameter. The date of the final entry corresponded with the dates on the calendar pads at Fort America. It was brief, neatly written, and completely exasperating:

"Routine landing at Tyler Field. Ship abandoned today, because of equalizer."

That was all, and it meant nothing.

"I don't get it." Doyle shook his head, staring bleakly at that faded page. "A spaceworthy ship. Competent officers, evidently, and a loyal crew. They make a routine voyage and a routine landing. Not a hint of anything unusual."

He peered up at Cameron.

"Then something happens," he muttered. "Something makes them walk off and leave their jobs and their duty and a ship and cargo worth hundreds of millions. Equalizer, huh? I don't get it."

We went back to the lifecraft, and moved nearer the deserted city. We landed again, in a suburban area which had been seared and flattened by some tremendous blast. The Geiger-Müller counter showed a lingering trace of secondary activity in the blobs of fused debris.

"An atomic explosion," Cameron decided.

"But not one of our standard robot missiles," Doyle added. "One shot from my launcher at Fort America would have leveled a hundred times this space."

We moved again, to a street in a still-standing suburb of detached, walled villas. Here, Doyle said, many prominent officials of the Directorate had lived, in an exclusive colony.

Doyle set down the lifecraft on a bit of unshattered pavement, that made a clearing in the brush. Frowning walls faced the street, overgrown with green vines now, and brilliant with blue morning-glories where the sun had not yet reached.

A tall gate of ornamental bronze sagged open, before the nearest building, and we pushed in through the tangle of long-untended shrubbery that had overgrown the lawns. An unlocked door let us into the mansion, and musty silence met us.

Here we found no hint of any popular uprising, against the ruling class. No bullet prints, no human bones, no smashed furniture, no looted safes and chests. The refrigerator in the great kitchen had been emptied, but long shelves were filled with fine cut glass and ornamental china. The gloomy library held thousands of volumes — but empty spaces seemed to say that others had been taken. Closets were hung with moth-ravaged clothing. A wall safe stood open; and Doyle explored the papers in it, with a frown of dull bewilderment.

"They left a fortune," he muttered incredulously. "This man—His Excellency, A. P. Watts, Director general of West Africa — must have been a lifetime piling up these stocks, annuities, bonds and shares, insurance policies, and deposit receipts. Then the thing happened—and he just walked off and left it all."

His eyes appealed to Cameron.

"I don't understand it." His deep voice seemed haunted. "They weren't killed—there would be more skeletons. They weren't even frightened—they didn't barricade their doors, or fire a gun, or even upset the furniture. They just set things in order, took a few useful items, evidently—and went away. 'Because of the equalizer.'"

His voice fell to a whisper of dull wonderment.

"But what does that mean—and where did they go?"

We moved the lifecraft again, this time into what had been an exclusive shopping district, where once, I fancied, the great men of the Directorate must have bought jewels and furs and perfumes for their mistresses, their secretaries, and perhaps even for their wives.

The street doors of these glittering shops were generally unlocked, or left wide open. Many shelves

were bare, as if the goods had been simply carried out, but there was little evidence of vandalism or violent looting. Unbroken windows still held garish displays of tarnished costume jewelry, and abandoned cash registers were still stuffed with currency and coin—from which I saw Lord's gunmen furtively filling their pockets.

We landed next in the middle of the city, in the wide empty canyon of Tyler Avenue. The massive granite walls were hushed and dead, but green weeds were pushing from every crevice in the hot pavements. A few sparrows were quarreling noisily about a window ledge.

"This was Squaredeal Square." Doyle's voice seemed too loud, in that sun-beaten silence. "If there was any fighting—war or rebellion—we ought to find the traces here."

Peering up at those splendid dead façades, I remembered that I had been here once before—in a great jamboree of the Tyler Scouts, when I was seven. There was Squaredeal Hall. There was the purple granite balcony where Tyler—or perhaps it was one of his public doubles—had appeared as we marched by, waving his arm mechanically as we screamed out the Tyler Song.

A diamondback, lazily sunning on the black granite steps of Squaredeal Hall, greeted us with a warning whir. Lord whipped out his automatic, with a nervous expertness, and shot it through the head.

The crash of his shot shattered that hot silence. It thundered back, appallingly magnified by those sheer granite cliffs. The dwarfish Squaredealer and his guards crowded apprehensively together, and we all listened uneasily. But the echoes faded unanswered; the dead city was not aroused.

Doyle led us up the steps, past the dead diamondback. Voiceless with awe, we went on between the immense square columns beyond. Here was the shrine of the Directorate. Tyler had surrounded his birthplace with a colonnade of purple granite, more majestic than Karnak.

Memory stirred again. After that review and jamboree, as a personal gift from Tyler, each scout had received a picture post card of the shrine. The little weatherbeaten farmhouse was shown beneath the towering columns, surrounded with an old-fashioned garden of zinnias and gladiola. The stone springhouse had been restored. The old apple tree, which the Director used to climb, was pink with blooms in the picture.

But the old tree was dead, now, and the house had fallen in. The mighty purple columns rose out of a green sea of weeds and sprouts and brambles. Wild morning-glories had buried the old springhouse. Something moved in the brush, and we heard the vicious warning hum of another diamondback.

Beside the useless elevator, we climbed a narrow stair. Tyler's own door, between two empty guard boxes, was left unlocked. We walked into the abandoned splendor of the Director's own apartment — and found no trace of violence.

On the high wall behind his desk and the office chair that had served him for a throne, a faded tapestry still hung, intact and undefiled, embroidered in gold with the three linked squares of the Machine.

The massive door of a huge fireproof safe swung carelessly open. Its compartments were stuffed with documents marked RESTRICTED or CONFIDENTIAL or SECRET. Letters, reports, beribboned executive decrees—the state papers of the Directorate, left heedlessly behind.

Lord, with a shrill excited shout, discovered a pile of heavy cloth bags that had been buried under the dusty documents in the bottom of the safe. Feverishly, he ripped one of them open, spilling out bright golden double-eagles.

"Millions—left behind!" Wide-awake, for once, his eyes glittered yellow as the metal; and his thin nasal voice was hushed with awe. "It must have been a terrible panic, to make them leave the gold."

But Cameron pointed to several empty compartments, and a blackened metal wastebasket, on the end of the desk, which was nearly full of gray ashes.

"No, it wasn't panic, Mr. Lord," he said respectfully. "Tyler had plenty of time to burn the papers he wanted to destroy. Then, I should imagine, he just walked out."

The little Squaredealer peered up at him, bewildered and visibly afraid.

"But why? Tyler wouldn't give up the whole Directorate."

The faded luxury of the great rooms gave us no answer. The paneled walls showed no marks of bullets. The dusty rugs showed no stains that could be blood. The Director's great bed, under its coverlet of dust, still was neatly made.

Doyle came back to Cameron, muttering the question that haunted us:

"Where could they have gone?"

Cameron rubbed his lean jaw with a brown forefinger.

"Let's try the country," he said thoughtfully.

Doyle stared at him, blankly. "Why?"

"People used to live in cities for certain reasons," Cameron said. "Just as they used to work for great corporations, or enlisted in the Atomic Service, or joined the Squaredeal Machine. Perhaps those reasons changed."

Lord blinked at him, sleepily.

"You had better watch your tongue," he warned sharply. "I believe you read too much, in Mr. Hudd's library. I'll be compelled to report your dangerous views, to the SBI."

But we went back to the lifecraft once more. Doyle landed it again, outside Americania, where a disused highway made a narrow slash through woods and thickets. We climbed down between the stabilizers once more, and Cameron pointed suddenly.

Planted in the middle of the old road, behind us, was a signpost. It carried a yellow-lettered warning:

DANGER!

Metropolitan Area

V.

Gathered in a puzzled little circle, we examined that sign.

"Well?" Doyle looked at Cameron.

"A remarkably strong aluminum alloy." Thoughtfully, Cameron rubbed his lean brown chin. "An excellent vitreous enamel. Evidently it was made and set up after the city was abandoned—to keep people out."

He started whistling gayly through his teeth, but Lord scowled him into silence. His blue eyes had lit with a speculative eagerness.

"And so?" prompted Doyle.

"Interesting implications." Cameron counted on lean brown fingers. "One, there are people. Two, they possess a high grade metal-and-enamel technology. Three, they have sufficient social organization to post public signs. Four, they don't like cities."

His eager eyes peered beyond the silver pencil of the lifecraft, down the dark leafy tunnel of the old road. He softly whistled another lilting bar, and then looked quickly back at Doyle.

"Let's take off again, captain," he suggested. "And follow the road, flying low. I think we'll find the sign-posters."

"We'll do that—" Doyle began, but the little Squaredealer interrupted him sharply:

"I'm in charge, and I don't agree." Lord's nasal tone was both insolent and apprehensive. "The jets are too bright and noisy. We'd be seen—maybe killed from ambush. Don't forget that melted money. No, we'll leave the craft hidden here, and go on foot."

Doyle's red head nodded soberly.

"A wise precaution, probably," he agreed. "We'll carry a radiophone. so we can call back."

And presently we left the bright craft hidden among the trees, and started cautiously down the green tunnel. Interlacing branches usually hid the sky. Vines and ferns made thick walls on either side. Jays scolded at us, and unseen things rustled in the brush. Once we came upon a red deer, which stood quite motionless in a little glade ahead with antlers high until Lord clutched for his automatic, and then bounded noisily away.

We were all, I think, keyed up and uneasy. The gloom of the forest darkened my own thoughts. Imagination turned small rustlings into startling threats. I recalled that the two other landing parties were long overdue, and I began to wish I had a gun.

Cameron walked ahead. His step was light and springy, and his hollowed face had a look of grave expectancy. Once he started whistling again, softly, and Lord stopped him with a snarled, low-voiced command.

We must have gone three miles, before Cameron turned from a curve in the old road, and plunged out of sight in the ferns and tangled vines. We followed him. A few yards brought us into daylight, on the rocky rim of a low sandstone cliff.

"The sign-posters," he said softly.

He pointed. Before us spread a

broad, shallow valley of woods and open meadow. The sun glittered from the curve of a stream. But I couldn't see any people.

"There's the house, against the other cliff. Reddish walls, and green roof." I found it, then—a low graceful building that had seemed part of the landscape. "I heard a man singing."

I listened. It was midafternoon, now, and a soft breeze had begun to disturb the midday hush. Leaves stirred lazily. I heard the sleepy hum of insects, the cool murmur of water running, a mockingbird singing — all wonderful sounds, half-familiar, that brought my boyhood back.

"Listen," Cameron urged.

There was a clear yodeling call—answered by a woman's voice.

"Keep down!" Lord's nasal voice was cautiously hushed. "We'll slip across, under cover. Study their weapons, and keep out of sight. If we're discovered—shoot first."

"Are you sure," Cameron protested, "that shooting's necessary?"

Lord's sleepy-lidded eyes narrowed unpleasantly.

"I'm running this show," he said, sharply. "I'll tolerate no meddling from you."

A fern-grown ravine let us down from the low cliff. We waded the clear stream, and climbed again through the woods beyond. Nearer the dwelling, the land had been cleared. We crossed an orchard of young apple trees, toward the voices of the man and the woman.

Twenty years at space had not made us expert stalkers. Dry leaves rattled, twigs cracked, and pebbles glattered. Lord turned, more than once, with a hissed injunction of silence. But at last we came on hands and knees to the grassy rim of another ravine, and peered down upon the unsuspecting two.

They were running a machine. The young woman sat in a little cab of bright aluminum, moving levers. A toothed bucket, on a long metal arm, scooped earth and stones from the side of the gorge, and filled a hopper.

The man held a thick, flexible hose, pouring a heavy yellow semi-liquid from the machine into a metal form across the little gorge. Presently he stopped to lift and adjust the plates of the form, and then poured again. Between the plates, I saw, a massive yellow dam was growing.

The machine ran quietly. There was only a subdued humming, and the occasional clatter of the bucket when sometimes it scraped a stone. It ate the dark soil, and poured out yellow concrete.

I peered at Cameron, astonished.

He made a pleased little nod.

"A very neat step forward," he whispered, "in basic technology."

"Silence!" Lord hissed.

Below us, the man called to the girl, and she moved the machine on its wide caterpillar tracks. I watched them, feeling an increasing glow of pleasure. For twenty years I had thought and dreamed of life on Earth, and here was a glimpse of it —as any lucky man might hope to live it.

The man was a lithe young giant, in shorts, bareheaded and brown. The sweat of his toil, in the hot afternoon, made a film that rippled and gleamed with every movement of his splendid body. Sometimes he paused to get his breath, smiling and calling down to the girl.

"Mushrooms for supper, what?" "Let's plant a lilac on the south terrace, shall we?" "I've thought of a name, darling—let's call him Dane Barstow. Dane Barstow Hawkins!"

That name gave me a puzzled shock. Dane Barstow was my father's name—but it seemed quite improbable that the expected young Hawkins should be named for an unsuccessful traitor, long dead in the labor camps of the SBI.

But I soon forgot my wonder, watching them. Their absorbed happiness set me to dreaming, wistfully. The girl was sun-browned as the man, slender, yet, and lovely. She ran the machine with a graceful skill, until a time when the man lost his balance as he hauled at the hose, and teetered on the edge of the dam.

She stopped the machine, then, with a sharp cry of alarm. After a moment of frantic clawing at the air, however, the man regained his balance. Seeing him safe, she laughed at him—a rich laugh, deep and musical and glad.

"Darling, if you had seen yourself! But please be careful—you're much too valuable to make into the dam! If you're so weak, we'd better stop—I'm hungry, anyhow."

"Laugh at me, huh?"

Grinning fondly through a mock ferocity, the man hung up the hose and dropped down from the dam. The girl scrambled out of the cab and ran from him, still laughing.

"Darling," she sobbed, "you looked so silly—"

"Stop 'em!" whispered Lord.

Instantly, the automatics crashed. The girl crumpled down, beside the bright machine. The man ran another step, uttered a loud strange cry, and fell sprawling on top of her.

Doyle made a hoarse outcry of incredulous protest. "What have you done?"

The dwarfish Squaredealer fired twice more, expertly. His bullets thudded into the quivering bodies. The bitter reek of smoke stung my nostrils. Nodding to his bleak-faced gunmen, he rose calmly to his feet.

"Well, they didn't get away." His nasal voice had a shocking complacency. "I thought they might have seen us. Now we'll have to work fast, to learn what we can and get away to space. Doyle, call the craft—have it brought here at once. Cameron, inspect that machine—Mr. Hudd will want a full report on it. We'll look for their weapons."

Doyle had the self-discipline of a good officer. He was white-lipped, stunned, but any protest must wait until the proper channels became available. The Squaredealer was his superior. He reached obediently for the little radiophone, which I had been carrying.

Cameron's discipline was not so fine.

"You fool!" His blue eyes glared at Lord, and his low voice crackled with cold anger. "You murdering fool! You had no excuse for that."

His brown fists clenched. For one terrified moment, I thought he was going to strike the Squaredealer. Lord must have thought so, too, for he nodded at his two black gunmen and stepped quickly back.

"Please, Jim." I caught Cameron's quivering arm. "You'll only get us shot."

"Quite right." Lord retreated again, watchfully. "Any further trouble, and I'll shoot you with pleasure. In any case, I shall report your insubordination. Now—if you want to go on living—inspect that machine."

Angrily, Cameron shrugged off my hand. He stood facing Lord, defiant. Slowly—with an eager, dreadful little twist of his thin, pale lips—Lord raised his gun. Cameron gulped, and shrugged hopelessly, and turned silently toward the bright machine.

Lord and his men searched the bodies. They found no weapons. The gunmen came back with a ring and a watch and a jeweled comb they had taken from the girl.

Cameron attacked the machine, with an intense, trembling savagery of movement—as if it had been a substitute for Lord. After a few moments, however, a sudden consuming interest seemed to swallow his wrath. His lean face was intent, absorbed. His fingers were steady again, very quick and skilful. Soon he was whistling with his teeth, so softly that Lord seemed not to hear.

I tried to help him, very ineffectually. The machine baffled me utterly. Obviously, it had turned ordinary stone and soil into a very strong quick-setting concrete, which was remarkable enough. There was, however, something more astonishing.

The machine had evidently used a great deal of electrical power. Electric motors drove the tracks and moved the bucket; heavy bus bars ran into the cylinder where soil became cement. Strangely, however, I couldn't find the source of that power. There was no lead-in cable, no space for batteries, no possible receiver for broadcast power, certainly nothing bulky enough to be any kind of fission engine. Yet there was current—as a painful shock convinced me. So far as I could determine, it just appeared spontaneously in the circuits.

Bewildered—and shaken by that unexpected shock—at last I merely stood back to watch. Working with such an eager-faced absorption that I didn't dare to question him, Cameron was studying a bit of the wiring which, for no reason that I could see, was formed into a double coil of odd, unhelical turns. Softly, he whistled a gay little air.

Lord had posted his two gunmen on either side of the ravine, with orders to watch for anyone approaching and to shoot at sight. He himself stood warily on the bank of the little gorge, watching Cameron. When Doyle had called the lifecraft,

Lord sent him and me to search the house.

"Look for weapons," he rapped. "Find out all you can, for our report to Hudd. And make it quick." His nasal voice was shrill with tension. "When the craft comes, we're getting out of here."

Doyle tramped in bitter silence until we were out of earshot, and then let flow a savage stream of low-voiced military profanity.

"That unprintable fool!" he finished. "Those poor farmers could have told us all we want to know, in five minutes—and that bloodthirsty little fool had to butcher them!"

He kicked angrily at a pebble, and then turned suddenly to me with a sympathetic look.

"I'm sorry about your friend Cameron," he said regretfully. "Lord doesn't like him, and you know the sort of report he'll make. I'm afraid Cameron's done for. He was just too independent."

VI.

Rory Doyle and I came up to the dwelling. The long, low building seemed all of one piece, a solid part of the hillside. It was apparently made of the same soil-concrete as the dam—differently colored in different rooms, the walls smooth and warm to the touch.

The furnishings gave an effect of sturdy and comfortable simplicity. The whole house seemed to tell of a warm, free, spacious sort of life—and a cold shadow fell across it, when I thought of its builders and owners, lying slaughtered in the gully.

Hastily, we explored the inviting living room, the workshop where a great, handsome table stood half-finished in a clutter of plastic dust and shavings, the big kitchen fitted with shining gadgets to manufacture plastic dishes and synthetic staples on the spot, the cold locker stored with a rich abundance of frozen foods.

We found no identifiable weapons. Nor any good reason, that I could see, why men had fled the cities and abandoned the old way of life. Instead, it was only another question that we found.

"They must have been quite self-sufficient." Peering about the silent rooms, Doyle tried to reconstruct the lives of the murdered couple. "I think they built and furnished this house, with their own hands—everything has the look of good, careful workmanship; they were adding a new room, that isn't roofed yet. Evidently they grew or manufactured their own food. That little machine in the shed is grinding a hopperful of leaves and sticks into something like cloth, very beautiful and strong. All these gadgets must use a lot of power."

His puzzled eyes came back to my face.

"But where does the power come from?"

I had to shake my head.

"The house isn't wired," I told him. "Each gadget seems to generate its own current—without any batteries or generator or anything

else that makes sense to me. Just like that machine at the dam."

On a table in the living room we found a telephone instrument, cradled on a little black plastic box that had no wires attached. Doyle picked it up impulsively, then reluctantly set it back again. He peered at several numbers written on a plaque beside it.

"We could call," he said. "Probably we could get somebody, and find out all we want to know. But Mr. Lord doesn't want it done that way."

We heard the roar of jets, then, and hurried back down to the ravine. Doyle had brought a blanket from the house, and he spread it decently over the two bodies.

Sinking slowly upon an inverted mushroom of blue electric fire, the lifecraft landed a hundred yards below the dam. Scorched weeds smoldered about the bright fins that held it upright.

On the bank of the little gorge, Lord turned from watching Cameron, to question Doyle. But he merely shook his head, with an empty-handed shrug, and Lord went back to shout at Cameron:

"On the double, now—it's time to go. Let's see what you've got."

Cameron came up out of the ravine, carrying something in his hand. It was a piece of thick copper wire, shaped into a double coil of oddly-shaped loops at odd-seeming angles, and held in shape with a transparent plastic rod.

"This is it," he said.

The hushed elation of his low voice told more than his words. I stared at him—for something, I thought, had somehow transformed him. His emaciated body had grown proudly straight. His hollowed face was smiling, with a stern joy which almost frightened me.

"Well?" Lord retreated a little, as if afraid of the look in Cameron's blue eyes. His sleek black head made a quick nod, to bring his two gunmen back from the ends of the unfinished dam. "Quick—what is it?"

Cameron held up that bit of wire on the plastic rod, with both his hands. His face had a look of solemn awe—as if the thing in his hands had been, somehow, an utterly priceless treasure.

"Speak up," Lord rapped nervously. "What is it?"

Cameron looked up at Lord again, with no awe at all. His blue eyes showed a sudden glint of ironic amusement. But still he held that bit of wire, as if it were a precious thing.

"It's what we've all been looking for." Cameron's voice held the eager ring of triumph. "It's the reason men abandoned Fort America, and deserted the cities. It is what happened to the Directorate, and to Tyler."

Cameron's eyes turned sardonic.

"It's also what is going to happen to the Task Force," he added softly. "And to Mr. Julian Hudd. And even to you, Mr. Lord."

Lord's sleepy yellow eyes slitted dangerously.

"I'll tolerate no further insubordi-

nation," he snapped savagely. "Just tell me what you've got."

Cameron turned to Doyle and me. Angrily, Lord hauled out his automatic, and then slowly thrust it back again. I suppose he saw the folly of extinguishing the source of information, and perhaps he was a little awed by Cameron's air of solemn exultation. But he still intended, I knew, to get his revenge.

Cameron ignored his sullenly boiling fury.

"Chad, you remember that little gadget we called an induction furnace? Well, we were on the right track—if I hadn't been afraid of blowing up the *Great Director*. And this is the thing we were looking for."

Generously, he gave me far too much credit. I had known, of course, that the device was something more than a furnace—for it made atomic changes in the metal samples we fused in it; and, instead of using power, it generated a dangerous surplus. That much I had known, and held my tongue about it. But I had really understood neither his effort nor his goal.

From me, Cameron turned impulsively to Doyle.

"Captain, may I have a word with you?"

"Of course." Doyle lifted his red brows, in puzzlement. "What about?"

"This." Cameron lifted the thing in his hands. "I've always admired you, captain, and I trust you now." He beckoned with his head, toward the end of the dam. "Let me tell you what this thing means to you—and all of us." He glanced aside at the simmering, suspicious little Squaredealer, and added: "Listen for just ten minutes, captain, and you'll be free of Lord and his sort."

Confusedly, Doyle shook his head.

"Careful, Cameron." I knew he was no friend of Lord's, but loyalty was part of his being. His voice was shocked. "Watch yourself—that sounds like treason, you know."

Cameron gave him a brief, sardonic grin.

"If there is such a thing, any longer." His low voice turned grave again. "Though I imagine that this little device has repealed a lot of the old laws." He glanced at the twisted wire, and regretfully back to Doyle. "I wish you'd listen, Rory. But I know how you feel, and I'll save your life if I can."

Little Lord was quivering with white-lipped fury. His hand hovered close to his gun. Yet caution or curiosity must have tempered his wrath, for he gestured sharply to halt his black-clad gunmen.

"Explain this strange behavior, Cameron," he snapped, "or I'll have to shoot you down."

And Cameron turned back to him, with a gentle gravity.

"No, I don't think you'll do that, Mr. Lord," he said, very softly. "Because you're an anachronism, now, along with the dinosaur and the atom bomb. Because technological advancement has passed you by."

Lord's narrow, sallow face turned dark with anger. Still, however, he seemed to want the secret of that

piece of twisted wire more than he wanted Cameron's life. For he nodded furtively to his gunmen, and they began edging aside, to Cameron's right and left.

"What's that gadget?" he snarled.

But Cameron, already, had turned to me.

"You'll come with me, won't you, Chad?" His low voice had a tremor of anxious appeal. "There's a job we have to do, with this." He moved the little device. "It's not too dangerous—if we're lucky. But I need you, Chad."

I wanted to go with him—wherever he was going. But I could see the two bleak-faced men moving warily to get behind him; I could see Lord's wolfish snarl and the cold menace of his yellow eyes; I could remember the SBI and all the cruel art of intensive interrogation. Somehow, that bit of wire and plastic had made Cameron seem a bolder and a bigger man, but still I hadn't felt the power of it.

Miserably, I shook my head.

"That's all right, Chad." He gave me a brief, cheering grin. "Perhaps I'll have a better chance alone, anyhow. And I'll do my best to save you."

"You, stand still!" Lord shouted, and sharply ordered his gunmen: "Shoot for the knees, if he tries anything."

Cameron turned back to him, soberly.

"Better call them off, Mr. Lord." Something in his low voice sent a shiver up my spine. "It's time for you to think of your own skin, now. Because it's clear, now, that you made quite an error, when you butchered that man and girl. You aren't very safe here, Mr. Lord—or anywhere."

The little Squaredealer must have heard that something in Cameron's voice, for his thin sallow face turned a sickly, yellow-gray. His perspiring arm gestured again, uneasily, to hold his gunmen back. His sleepy eyes blinked apprehensively.

"I'll be back," Cameron stated softly. "But I advise you not to follow."

He dropped into the ravine, up beyond the dam.

Lord hesitated for a long second, pale and breathless.

"Get after him," he screamed at last. "Shoot him in the legs."

He didn't lead the pursuit, however, and his men weren't eager. That same something in Cameron's voice must have made them doubt that it was really wise to follow. They ran uncertainly along the rim of the little gorge, and fired a few wild shots.

Ahead of them, something flashed. Its terrible brightness made us duck and shield our eyes, even in the full daylight. The detonation came instantly—a single, terrific report. A green tree, beside the ravine, shattered into smoking, whistling fragments.

Lord and his two men followed no farther. As soon as the burning splinters stopped falling, they scrambled up off their faces, and hastily retired.

"Unprintable civilian," gasped the little Squaredealer. "He'll regret this." He made a rather fearful

gesture toward the lifecraft. "On board!" he shouted. "We're getting out of here."

VII.

We tumbled through the valves, and Lord ordered Captain Doyle to blast away at full thrust. Before Doyle could reach his bridge, however, the signal officer shouted down the ladder well:

"Captain Doyle! I've just got contact with the *Great Director,* and Mr. Hudd is on the screen. He wants a full report, at once, sir."

Earth's intervening mass had cut off microwave transmission since we dropped over the bulge of it, before we landed; now, however, the planet's rotation had brought the flagship back above the horizon. We climbed hurriedly into the little television room.

Gigantic on the screen, Hudd boomed his question:

"What's the story, Lord?"

"A crisis, Mr. Hudd!" Lord looked damp with sweat, and his voice was agitated. "We're in danger. I request permission to blast off at once, and make our full report at space."

"What's the crisis?"

Lord gulped, uncomfortably. "Your smart civilian, Cameron, got away."

Hudd's great, blue-jowled face was furrowed with sudden concern.

"Then I'll take your full report, Mr. Lord," he said decisively. "Right now."

"But this civilian mutineer has got a weapon," Lord protested desperately. "Something that strikes like lightning—"

"Then the entire Task Force may be in peril," Hudd cut in. "Now let's have it—at once."

Lord talked rapidly, while sweat burst out in shining drops on his narrow face, and soaked dark blotches into his uniform. Hudd listened gravely, now and then turning to Doyle or me with a terse-voiced question.

It was Doyle who told him how Lord and the two guards had shot the couple named Hawkins. Hudd's heavy, sagging jaw turned hard, at the news. When the report was finished, he must have started his habitual nervous drumming—his hands were hidden, below the screen, but the speaker brought a worried rapping.

"You made two blunders." His small, troubled eyes peered accusingly at Lord. "You let Cameron get away with the vital information I sent you for. And you killed those people, before they had a chance to talk. I'm afraid you have gravely compromised our objectives, Victor—and your own future."

All his swagger gone, Lord twisted and cringed before the steady eyes of Hudd. Still perspiring, he seemed to fawn and cower like a punished dog. And the loud, aggressive voice of his master continued:

"We must take bold, immediate action, Victor, to restore the situation."

"Right, Mr. Hudd," Lord said eagerly. "Shall we blast off, now?"

"You will remain where you are,"

Hudd said flatly. "Get in touch with the inhabitants, if you can. Offer apologies and compensation for the killing, and stall for time. Find out all you can about the weapons, the military establishment, and the government of the inhabitants."

Lord gulped uneasily, nodding.

"Post a reward for Cameron." Hudd's big mouth set hard. "My mistake, to trust him. Get hold of him. Use extreme interrogation. Make him talk, and liquidate him. He has gone too far."

Hudd shook his massive, shaggy head, somewhat regretfully.

"Too bad," he added heavily. "Because I always liked him."

I felt cold and ill. Hudd's loud words had struck me like numbing blows. That harsh command was no surprise to me, but it brought me a dull sickness of regret, that I had failed Cameron when he asked me to go with him.

Lord was protesting again, breathlessly:

"Mr. Hudd, I think we'll be attacked—"

"I'll support you," Hudd assured him, and turned off the screen to speak to his signal officer: "Change the scramble code—we don't know who is trying to listen."

The unseen officer on the flagship droned out a code number, repeating each digit. Our officer droned it back. The screen darkened, flickered. Then the image of Hudd came back. huge and resolute, declaring:

"Whatever happens, Victor, I intend to restore the Directorate.

I am taking prompt action, to that end. The *Valley Forge* and the *Hiroshima* are proceeding to the Moon. They will land a new garrison, with the necessary repairs to bring Fort America back into effectiveness. The *Yorktown,* the *River Plate,* and the *Leningrad* will stand by, spaced on an orbit ten thousand miles from the Earth, to relay communications and bombard any targets we discover.

"With the *Great Director,* I'm coming to Earth."

Lord licked his thin, colorless lips.

"You're too daring, Mr. Hudd," he protested shrilly.

"It took audacity to establish the Directorate." The great boom of Hudd's voice in the speaker visibly startled Lord. "It's worth audacity to restore it. I'm coming, at full thrust, to take personal command."

Lord remained aboard the lifecraft, that night. His uneasy fancy must have dwelt upon the fused metal we had found beside that skeleton in the weeds, and the sudden bolt which struck that tree as Cameron fled. Perhaps he regretted the two still bodies in the gully, and no doubt he peopled the dark valley with vengeful enemies.

My own imagination, I know, was busy enough. Staring out into the thickening night, I felt myself the helpless spectator of stupendous forces sweeping grandly toward collision.

On one side, there was the Atomic Age itself, expressed in the rekindled might of Fort America, in the fine discipline of the Task Force, in sleek guided missiles, and in the determined sagacity of Mr. Julian Hudd.

On the other side, there was that unknown power that had swept the old garrison from the Moon, and driven men from the cities, and destroyed the Directorate. All I had seen of it was a piece of twisted wire, a blasted tree, and the change in Jim Cameron. But that was enough—I waited for the fireworks.

After dark, Captain Doyle volunteered to go back to the house.

"Mr. Hudd wants us to get in touch with the inhabitants," he reminded Lord. "And we saw some kind of telephone, there."

Lord agreed, with evident reluctance.

"If you contact anybody, call for the government," he ordered. "Offer a reward for Cameron." His sleepy eyes glittered cunningly. "If anybody mentions those two dead peasants, we're holding them—alive—for Cameron's return."

Doyle went down through the valves, accompanied by the signal officer to help him work the strange radiophone. They were lost in the pale moonlight, among the young apple trees. They didn't come back.

After an hour, Lord sent me after them, with one of his gunmen for escort. Soft lights came on of themselves, when I opened the door. I tried to call Doyle's name, and found that my voice had gone to a grating whisper. We walked through the silent rooms, and found nobody.

The little radiophone, oddly, was also gone.

At midnight, Hudd called again.

At the news of Doyle's apparent desertion, he muttered forebodingly:

"It's something pretty sinister, that takes so true a man."

The Interstellar cruiser landed, just at dawn.

The thunder of it woke me out of a nodding doze, in the acceleration room. I moved groggily to a port, and saw a glare that burned all color out of the valley, so that everything was dark and blinding white. I had to cover my smarting eyes. Wind rocked the lifecraft on its stabilizers, and the Earth shuddered.

When the thunder ceased and that cruel light was gone, I saw the cruiser standing two miles down the valley. Dark smoke billowed up about the base of it, from the green forest burning. Its tall peak, towering out of the night in the valley, was already incandescent in the sunlight.

Immensely far above us, the great flat turrets swung with ominous purpose. The huge bright tubes of rifles and launchers lifted out of their housings, ready. And Hudd called again, looking as massively indomitable as his flagship.

"Have you met the inhabitants, Mr. Lord?"

"Not yet, Mr. Hudd." Haggard for want of sleep, Lord seemed relieved by the great ship's coming; he had his swagger back.

"You're going to," Hudd told him. "Our lookouts report a small helicopter, approaching you now. Contact them, and report immediately."

Sunlight glinted redly on a bright, silent rotor. The machine landed above us, beside the unfinished dam. Four people got out. One of them began waving a bit of white cloth. With a shock of dismay, I recognized Jim Cameron.

VIII.

Cameron planted his flag of truce. Moving with a solemn deliberation, the four carried the bodies out of the gully on blanket-covered stretchers, and loaded them in the helicopter. The pilot took his seat and departed with them, flying low over the green ridge. Cameron and two others were left behind. He took up his white flag and came halfway to us, then stopped and stood waiting.

Watching through a port in the signal room, Lord nervously wet his lips. Beneath a puzzled unease, his sleepy eyes had a glare of yellow elation. He sent me out to find what Cameron wanted.

Cameron grinned with pleasure to see me, and put down the stick with his handkerchief tied to it. Fatigue had drawn his stubbled face, and smudged blue shadows under his eyes.

"Jim, you shouldn't have come back." I pitched my voice too low for Lord's gunmen, covering us from the valve. "Because you made a fool of Lord, when you got away. He'll never forgive that, and he's got Hudd's permission to liquidate you."

He grinned wearily, and glanced at the two behind him.

"You can tell Mr. Lord that he's in no position to liquidate anybody.

On the contrary—these neighbors of the Hawkins couple have come to arraign him and his guards for the murder."

I must have gaped with astonishment.

"I'm afraid Lord will be unreasonable," he went on, regretfully. "I came along to try to prevent any needless destruction. There's not much use for Lord to resist, and no need for others to be killed. You can tell him that."

Back aboard the lifecraft, I told Lord what the strangers wanted. His pale, peering eyes went round with wonderment, and then narrowed to hard yellow slits. He glared malevolently out at Cameron.

"I suppose that civilian is the chief witness? Well, I'll fix the lot of them!" And he shouted up the ladder well to the astrogator, now replacing the missing signal officer: "Get me Mr. Hudd!"

I followed him into the narrow signal room.

"It's your pet civilian," he shouted bitterly, when Hudd's shaggy-browed face appeared huge and interrogative on the screen. "And a couple of yokels with some nonsense about arresting me for murder. We let them get away with the bodies."

"So?" Hudd rubbed his blue, multiple chin, thoughtfully. "Now, I want to talk to them. Offer them all three safe-conduct, to come aboard. Tell them I'll discuss compensation for the killing. You can bring them on the lifecraft, Mr. Lord."

The negotiations which ensued were somewhat involved. I went back and forth, between Lord and Cameron. Cameron returned to consult with the watchful two by the ravine. Hudd and Lord conferred by television, Lord's nasal voice rising steadily with ill-concealed anger, Hudd frowning with increasing concern.

"I'd accept Mr. Hudd's safe-conduct, myself," Cameron said. "But the Enlows don't want to trust him. They are willing to talk to Mr. Hudd, but he'll have to come out here."

With a surprising boldness, Hudd agreed to do that.

"But, Mr. Hudd!" Lord protested sharply. "We can't treat with a deserter and two ragged peasants. And think of your own safety—that weapon Cameron found! Why not let us take off, sir, and then wipe them out with a salvo of radiotoxin shells from the cruiser?"

Hudd shook his head, ponderously determined.

"I'm coming over, Victor, to handle this myself." His red, worried eyes turned to me. "Chad, you go back and tell Jim Cameron to wait till I get there."

Lord's heavy-lidded eyes narrowed suspiciously.

"Don't you give me up, Hudd." His angry nasal voice was hard and dangerous. "If you do, you're also giving up your New Directorate."

"I know that," Hudd assured him blandly. "You can trust me, Victor."

Lord dismissed me, with a curt, sullen nod. I went back across the

burned grass to Cameron, and told him that Hudd was coming.

"He's smart." Cameron nodded, approvingly. "Maybe he can save his neck." He took up the white flag again. "Now we had better rejoin the Enlows," he said. "They might misunderstand something."

We walked back to the people waiting at the dam. I thought of Lord's gunmen crouching in the lock behind us, and the skin on my back crawled uneasily.

The two were a man and a young woman. They both looked sun-browned, lean and sturdy; their dark hair and gray level eyes showed a family likeness. Their faces were tight with the shock of what they had found under the blanket, and hard with purpose.

"Are they coming out?" The man's quiet voice was taut as his gaunt face.

"Not yet." Cameron was urgently persuasive. "But please give me a chance to tell Mr. Hudd about the equalizer. I think he's smart enough to listen."

The man nodded his lean, weatherbeaten head. I saw that he carried what looked like a bulky flare pistol. His deep-set angry eyes peered up at the enormous flagship, not at all afraid.

"If he wants to listen," he agreed. "But we're going to get the killers."

"I'll try to get Mr. Hudd to give them up," Cameron promised, and then he introduced me. "Chad Barstow. A likely candidate for the Brotherhood, as soon as he learns to use the equalizer."

The girl wore a radiophone, much like the one we had seen in the house—it must have been such units that made those scrambled signals we had heard. The little plastic case was snapped to her belt, with the headset over her dark lustrous hair. She had been listening to that, but now she looked at me, her eyes wide with a surprised interrogative interest.

"Yes, he's Dane Barstow's son." Seeing her troubled glance toward the gully, Cameron added quickly: "He had nothing to do with that."

She gave me a quick, strong handclasp.

"Jane Enlow," Cameron said. "And her father, Frank Enlow."

The gaunt man took my hand, silently, and his angry, watchful eyes went back to the lifecraft and the cruiser.

"Before the equalizer," Cameron told him, "Mr. Enlow was a janitor in Tyler's Squaredeal Hall. He was just telling me about the Director's last days. After the equalizer, he smuggled Tyler out through the mob that was shouting for him, under the balcony. Tyler lived for years, in Mr. Enlow's house over the ridge, yonder, writing a history —trying to justify his career."

"A nasty old man!" Jane Enlow pouted her full lips. "He wouldn't learn the equalizer, so Dad had to take care of him."

High up on the bright side of the cruiser, blue fire spurted. Frank Enlow crouched toward the ravine, swinging up his pistollike device. Cameron called out, hastily:

"Don't shoot—that's probably Mr. Hudd."

The gaunt man relaxed, and I studied his weapon with a shocked fascination. It looked like a miniature guided-missile launcher, rather than a gun. It seemed fantastically small, and yet the lank man had a strange, confident air of facing the cruiser's appalling weapons on even terms.

The girl was listening again to her radiophone. She twisted knobs on the case at her belt, and finally shook her dark head.

"Nothing." Her voice was gloomy. "They're taking too long."

Hudd's lifecraft approached us swiftly, a bright projectile floating nearly upright on a jet of screaming fire. It crossed the burning forest, and landed near the other craft. The valves slammed open, as soon as the dust had cleared, and Hudd's aide jumped out.

The hard-bitten commander darted across the blasted ground, and hurried up to us. He seemed quite upset by Hudd's decision to risk his important skin in the open. First he wanted Cameron and the Enlows to come aboard the lifecraft to talk; then he wanted to send out a bodyguard with Hudd; finally he warned that a general bombardment of the surrounding country would begin at once, if anything happened to Hudd.

"We've come for the killers," the lean man informed him gravely. "Mr. Cameron has taken the Brotherhood oath, and the three of us form a competent court. We're bound to listen to any evidence that Mr. Hudd can offer. He will not be harmed, unless he tries to interfere."

Outraged, the commander went back, and immediately Mr. Julian Hudd climbed down between the bright fins. He came out of the burned area at a painful, heavy run. Still gasping for breath, he waddled up to the dam.

"Well, Jim!" His great voice was bold, even hearty.

He shook hands with the rawboned man, and gave the girl a bow of open admiration, when Cameron introduced them. His small, shrewd eyes studied the unfinished dam, and the abandoned machine in the gully.

"The incident here was most re-regrettable." Hudd's voice was a chesty, confident rumble. "I'll see that adequate compensation is paid. Personally. You people needn't concern yourselves any further."

His keen bloodshot eyes studied the gaunt man.

"Now, I want to take up something more important. I've been trying to get in touch with your government." His broad, blue-tinged face was still a genial mask, but his loud voice turned imperious. "I demand that your government—"

The lank man's voice was very quiet, yet the cold ring of it made Hudd stop to listen.

"We have no government," said Frank Enlow.

Hudd puffed out his cheeks, slowly turning a mottled red with anger.

"That's the surprising fact, Mr. Hudd," Cameron assured him gravely. "You'll have to get used to it.

When the equalizer happened, nations became extinct."

Ignoring him, Hudd glared at the lank man.

"You must have some organization."

"Only the Brotherhood," Enlow said. "It has no power to surrender anything to you, because membership is voluntary."

Hudd's red eyes blinked, skeptical and defiant.

"Get in touch with this Brotherhood." His voice was rasping, arrogant. "Have them send a responsible agent, to be here by noon, local time." He paused, ominously. "Otherwise, the Task Force and Fort America will open fire, at every likely target we can find."

Cameron made a startled gesture, as if to catch his arm.

"Please, Mr. Hudd," he protested sharply. "Wait till you know what you're doing."

Hudd kept his savage, shaggy-browed little eyes on Enlow.

"The young lady, I see, has a radiophone." His voice was loud and ominous. "You had better start calling this Brotherhood—and get their answer by noon."

"We came here for another purpose." The lank man met his truculent gaze, unimpressed. "We've come for the killers."

Hudd's bluish face swelled again with anger.

"Nonsense!" he shouted. "Mr. Lord is my second in command. He was acting under orders. I assume the responsibility. I'll pay for any unjust damage, but I refuse to subject him to any humiliation."

The lean man listened to that, and nodded his rawboned head, and stalked away silently toward the ravine. Cameron hurried after him, visibly alarmed.

"The killers can wait," he called urgently. "Because Doyle must be trying, and Mr. Hudd doesn't understand the equalizer. Please give me time to tell him about it."

The lank man turned back, solemn.

"If he wants to listen," he agreed. "We'll wait half an hour."

With a question on his face, Cameron turned to Hudd.

"All right, Jim," Hudd gasped, explosively. "I wanted to know about this equalizer, anyhow." His red angry eyes went back to the gaunt man, and he added harshly: "But my ships and the fort will open fire at noon."

IX.

Hudd sat down on a hummock of grass, breathing hard with the effort of moving his clumsy bulk. His massive shoulders bunched with bold defiance. Only the quick movements of his eyes betrayed the intense and desperate working of his mind—they were the eyes of a fighting animal, fearful, yet audacious, and altogether ruthless.

"Now!" he gasped. "This equalizer?"

Cameron squatted on his heels, facing Hudd. Behind us, as he talked, the sun rose higher. The flat green valley lay motionless under its hot light, and a pungent blue haze settled about us from the green forest burning.

"I heard the story last night. The beginning of the equalizer takes us back nearly twenty years." Cameron's tired, dark-smudged eyes came for a moment to me. "To your own father, Chad."

His haggard and yet animated face turned back to Hudd.

"I think you remember Dane Barstow?"

"The traitor?" rumbled Hudd. "He died, I believe, in the labor camps."

"But he didn't," Cameron said. "Because Tyler learned that he was on the trail of something remarkable, and had him taken out of the camps, out to a solitary cell at Fort America. The SBI went to work on him there, with extreme interrogation."

Cameron glanced at me again, and I noticed a strange thing. The story and the memory of my father's misfortunes brought me a bitter resentment, but now I noticed that all the old pain and hatred were gone from Cameron's drawn and stubbled face. Something had swept away his old saturnine reserve. He seemed friendly even to Hudd.

"Finally," he went on, "Barstow talked. He told the SBI what he had done, and admitted all he had hoped to do. He even agreed to complete his interrupted work."

I knelt down beside him to listen, breathless.

"Though he was half-blind and crippled from the extreme treatment, and sometimes out of his head, they took pretty drastic precautions. They kept him locked in that steel cell on the Moon—one of those we saw there, I imagine, Chad. Two guards were always with him. He was allowed paper and pencil, but no other equipment. If he wanted calculations made, or any experiments tried, that was done for him by Atomic Service engineers."

Cameron briefly smiled, as if he shared my pride.

"Yes, Chad, your old man was all right. Working under such difficult conditions, shattered as he was, he charted a new science and created a new technology. And then—when we had been out at space about two years with the Task Force—he overturned the Directorate."

Hudd's bold eyes had drifted back to the sun-browned girl—who was listening, not to Cameron, but anxiously to the little portable radiophone. But now he started ponderously, at Cameron's last words, and gasped heavily for his breath, and wheezed incredulously:

"How could he do that?"

"Not so hard, with the equalizer." Cameron grinned at Hudd's blinking, startled stare. "Barstow smashed the Directorate, from his cell on the Moon. He didn't need any weapons, or any equipment. All he had to do was tell his jailors what he had discovered."

Hudd made a hollow, croaking sound. "How's that?"

"The news of the equalizer spread, from one man to another," Cameron said. "Those same engineers, who had been assigned to get the invention from him, set up a little illicit transmitter and beamed the details back to Earth with equalizer

power, on every frequency they could get through the ionosphere.

"That finished the Directorate."

Hudd picked up a red pebble and began nervously tapping the sod with it, reminding me of the way he had drummed on his polished desk with the little gold head of Tyler. His furtive eyes flashed to the lean man's weapon, and back to Cameron's face.

"That's too much!" His loud voice was harshly unbelieving. "No mere fact of science could defeat the Atomic Service, or wreck the Squaredeal Machine."

"Barstow's equalizer did," Cameron assured him gravely. "Perhaps because the old technology of the Atomic Age had already reached the breaking point of over-complexity and super-centralization. When Barstow created this new technology, there was a natural swing to the opposite extreme—to simplicity, individualism, and complete personal freedom."

"So?" Hudd thumped on the sod with his pebble, scowling at Cameron. "Just how does it work, this equalizer?"

Cameron glanced doubtfully at Frank Enlow.

"Tell him," the gaunt man said. "Barstow wanted every man to know, and generally it has a good effect." He glanced at a watch on his brown wrist. "But hurry—your time is running out."

Hudd's great shoulders lifted with aggression.

"And so is yours," he snapped. "I'm willing to listen, but my men won't hear. I'm not yielding anything. And your Brotherhood had better throw the towel in, by noon."

"Tell him," Enlow repeated.

And Cameron launched into his explanation. His fatigue seemed forgotten, and some inner excitement made his haggard face almost vivacious.

"The old atomic power pile, you know, was an enormously clumsy and wasteful and dangerous way of doing an extremely simple thing. Pure energy exists in the atom, and that is what we want. But the pile used intractable and inadequate processes, to change kinetic and electrical and binding energy into heat, and then required expensive and inefficient machinery to turn a little of that heat back into electricity.

"Even with all its elaborate complexity, the pile could tap only a little of the binding energy, which holds electrons and protons and neutrons together into atoms. The mass energy of the particles themselves, composing nearly all the actual energy of the atom, it couldn't even reach.

"Barstow's dream—like my own—was merely a simple way of doing a simple thing. Material energy exists, as Einstein first demonstrated. Barstow dreamed of a simple way to let it flow. The equalizer is his dream, realized."

I couldn't help the breathless interruption:

"That piece of wire?"

"Just a solenoid." Cameron nodded. "But wound in a certain way, not helically, so that its field slightly alters the co-ordinates of

space, and slightly changes the interaction of mass and energy. The atomic particles of the solenoid are equalized, as your father termed the process, and the converted energy appears as direct current in the wire.

"The fact is simple—even though the tensors of a new geometry are required to describe the solenoid field. That apparent complexity is more in the awkward description, however, than in the vital fact. The actual specifications of the equalizer can be memorized in five minutes."

Cameron's intent, elated eyes looked aside at me.

"The safety feature is what threw us, Chad, with our induction furnace experiments," he told me. "Our gadget annihilated matter—degenerating iron atoms into sodium — and produced electric current. The increased output intensified the conversion field, and the intensified field increased the output. An excellent arrangement, if you want a matter bomb —but highly unsafe for a power plant.

"Your father solved that problem, Chad—very simply, too. Just a secondary solenoid, in series with the primary, which develops an opposing voltage as the equalizing field expands. It gives you a safe, guaranteed maximum voltage—the value determined by the way it's wound."

Hudd's deep-sunken eyes blinked skeptically.

"You mean, you can generate electricity?" he rasped. "With just a coil of wire?"

"And a few stray ions to excite it," Cameron told him. "A pound of copper solenoid would drive the cruiser, yonder, out to the Dark Star. Or iron, or silver—the metal doesn't matter; it's only the precise shape and alignment and spacing of the turns of wire."

Hudd shook his head, in massive unbelief.

"Perpetual motion!" he scoffed.

"Almost." Cameron grinned. "Equalized mass is converted into energy, according to the Einstein equation. The solenoid wastes away—but slowly. One pound of solenoid will generate ten billion kilowatt hours of electricity."

"If it's all that simple," Hudd objected shrewdly, "somebody would have stumbled on it, by accident."

"Very likely, men did," Cameron agreed. "Not many—the shape of the coils is not one you would want, for anything else; and the turns must be very exactly formed and aligned, or else the regenerative effect is damped out. The few who did it must have been instantly electrocuted—because they didn't also stumble on Barstow's safety-winding."

"I'll believe it when I see it," muttered Hudd.

Cameron pointed up the edge of the ravine, to a shattered tree stump.

"Mr. Lord wanted a demonstration, yesterday," he said. "I straightened part of the safety coil on a power unit from that machine, to step up the voltage, and tossed it into a green tree, yonder."

"A rather reckless thing to do," commented the lean man.

Hudd said nothing. His black-haired, ham-sized hand tossed the red pebble, aimlessly, and caught it again. His small, troubled eyes peered at the stump, and the gaunt man's weapon, and the enormous tower of the *Great Director.*

"You have ten minutes to give up the killers, Mr. Hudd," drawled Frank Enlow. "Or you'll see a better demonstration."

Hudd snorted: a blast of defiance.

"I'll wait for it," he gasped. "You can't bluff me."

A shadow came over Cameron's haggard face. His tired eyes closed for a moment, and I saw the blue stains under them. He sat back on his heels, his emaciated body sagging as if from a punshing blow.

"It's no bluff, Mr. Hudd." He paused as if to gather himself for a weary and yet vehement protest. "You just don't grasp what the equalizer means. It ended the Atomic Age. The Directorate was part of that lost era. You can't hope to restore it, now, any more than you could revive a fossil tyrannosaur. You can only cause needless bloodshed and death."

Hudd's mouth hardened, with an unconvinced hostility.

"Tyler spilled plenty of blood, building the first Directorate," he commented coldly. "Perhaps I'll have to pay the same price again, but I expect to win. Maybe Tyler's men mutinied, when they heard about this wonderful equalizer. But mine have better discipline—and they won't hear about it."

"It wasn't mutiny, Mr. Hudd," Cameron insisted. "There was no fighting. The Directorate wasn't overthrown—it simply ceased to exist. When the equalizer happened, there was no more reason for Fort America than there is for arrow makers. The officers recognized that, as well as the men. The garrison just packed up and came home."

"Home to what?" Hudd challenged, scowling shaggily. "The people here were already deserting the cities, leaving nearly everything they owned. There must have been something else — perhaps some frightful biotoxin, loose—to cause such panic."

"You still don't get it." Cameron shook his head, with a tired impatience. "The equalizer freed the city dwellers, just as it did the garrison. Because most people didn't live in cities by choice. They were huddled into them by the old division of labor—specialized cogs in a social machine grown ruinously complex.

"But the equalizer abolished the division of labor—at least in military technology. Every man with a piece of wire became a complete military specialist, competent to defend himself. With the new control of atomic and molecular processes, he could also provide for nearly all his own ordinary wants. Complexity was replaced with stark simplicity.

"Take the couple who lived here." He nodded regretfully at the empty house behind us. "They built their own home, made their own food and clothing. They were setting up this dam, when they were murdered, to save their own land from erosion. They weren't slaves of any single skill, or prisoners of any class; and they had no

reason to hate or fear their neighbors—until we came along."

Hudd blinked, still doubtful.

"But why were the cities so utterly abandoned?" he questioned. "And all that money left behind, as Lord reports? And those signs posted, to warn people out?"

Cameron glanced up at the great frowning ship, uneasily.

"The cities were a product of the old technology, and they died with it," he argued doggedly. "The day of the equalizer, workers walked out and services stopped. There was no food, no power, no water, no sewage disposal. City life was impossible, without division of labor.

"As for money, paper dollars were only shares in the extinct Atomic Age. Metal was still useful—but the equalizer must have made it easier to refine new metal than to wreck the cities. About the danger—I forgot to ask."

He turned inquiringly to Frank Enlow.

"Criminals," the lean man drawled. "A few men and women too stupid or too vicious to use the equalizer. They never left the cities. They stayed hidden, and tried to live by raiding and looting. They used the old military weapons, and a few of them became very cunning and dangerous. The signs were posted during our campaigns to hunt them out."

"Don't you have worse criminals?" Hudd demanded. "Those who do use the equalizer?"

Enlow shook his head.

"The users of the equalizer have very little economic reason for crime," he said. "And people armed with it aren't very likely victims. It's just because crime has become so rare, that the Hawkinses weren't alert."

Hudd's eyes dwelt on the lean man's weapon.

"This Brotherhood?" he asked shrewdly. "If it isn't a government—what is it?"

"A voluntary substitute." The gaunt man glanced at me. "Your father's last great project, Mr. Barstow. After he got back his health, he spent the rest of his years organizing the Brotherhood."

"Just what does it do?" Hudd persisted.

"It runs schools and libraries and hospitals," Enlow told him. "Supports laboratories. Builds irrigation projects. Anything for the public good. It operates the post office, and issues money."

Hudd nodded triumphantly.

"If it can do all that, it can surrender to me."

"The Brotherhood has no authority." Enlow shook his head, rawboned and resolute. "People may join or leave it, as they please. It is supported by voluntary contributions, and the elected officers serve without pay. They can't surrender, Mr. Hudd—but they can organize the common defense."

"If you have no law," Hudd demanded shrewdly, "then why do you want Mr. Lord?"

Enlow stared back at him, brown and lean and angry.

"In the Brotherhood, we enter a voluntary agreement to respect and defend the rights of others. I think your Mr. Lord has proved himself a public menace."

Hudd pulled absently at his thick lower lip.

"If you've got no government," his harsh rasp came, "then I think you've got a madhouse—and all the madmen armed with insane weapons."

Enlow shook his dark head, with a lean dignity.

"You're living under a false philosophy, Mr. Hudd," he said softly. "You believe that men are evil, that they have to be driven. Fortunately, that philosophy is mistaken—because men with equalizers can't be driven."

Hudd made another derisive snort, and Enlow looked at his watch.

"Unfortunately, a few men are bad," he added gently. "Your time is up. We want those killers."

Cameron turned back to Hudd, importunately.

"Why don't you give them up?" he urged. "And let me tell your men about the equalizer?"

"I will not." Hudd came laboriously to his feet, red and gasping from the effort. "I still think you'd have a hard time to silence Fort America—with all your equalizers. And my ultimatum still expires at noon."

Having delivered that ominous blast, Hudd turned back to Jane Enlow. She had been listening to her radiophone, absorbed. Now, becoming aware of Hudd's hungry eyes, she started, and rich color stained her tan. Hudd made her a bow, ponderously graceful, in the continental manner he must have learned while he was Tyler's Director general of Europe.

"I deeply regret the awkward circumstances of this first meeting, Miss Enlow"—he smiled, in genial admiration—"but I hope soon to offer you an introduction to the best society of the New Directorate."

Flushing deeply, she said nothing.

Hudd bowed again, after a moment, and stalked heavily back toward his life craft.

Little Victor Lord, watching from the other craft, must have misunderstood that bow. I can imagine his sweating consternation when he saw the apparently friendly ending of the little conference and decided, no doubt, that Hudd had abandoned him.

The crewmen, evidently, opposed his flight.

The sudden crash of guns made a muffled booming in the thin bright hull. Two spacemen jumped wildly out of the open valve, which slammed immediately behind them. One of them stumbled to his knees, pressing red, agonized hands against his wounds. The other tried to drag him out of danger—until the incandescent blast of the jets flattened and hid them both.

X.

The fugitive life craft lifted on that column of thundering fire, at

first very slowly and jerkily—Lord was not an expert pilot. It leaned drunkenly from the upright, and I thought it was going to crash. But the roar was suddenly louder. It lifted, and swept above our heads, and hurtled northward up the valley. Behind it, when the dust and smoke had cleared, the blackened forms of the two spacemen moved no longer.

The tall man turned, with his gaunt face grimly angular, and watched the life craft go. It became a vanishing point of bright metal and violet fire. Its thunder rolled away.

His clumsy-seeming weapon lifted, at last, and clicked.

"Down, Barstow!" the girl screamed at me. "Cover your eyes."

Astonished to find that I was left standing alone, I dropped. The flash of heat stung my skin. I looked, then, in time to see the small bright cloud of iridescent metal vapor fading in the blue northward sky, and turning into a white tuft of rising cumulus. The crash came nearly a minute later, like one loud peal of thunder.

Enlow shook his lean head, regretfully.

"Too bad it happened that way," he said. "The two guards were only obeying orders. The equalizer might have made them very good members of the Brotherhood."

Calmly, as he spoke, he slipped another little self-propelled missile out of a case at his belt, pulled a safety key out of it, and pushed it down the muzzle of his launcher. Shaped very much like the huge guided missiles of Fort America, it was about six inches long.

Halfway to his own craft, Mr. Julian Hudd stood peering back toward us. He was shading his eyes, dazedly shaking his dark shaggy head, as if the flash had nearly blinded him.

"Your demonstration, Mr. Hudd!" Cameron shouted after him, urgently. "Now will you give up your New Directorate?"

"Jim, this is an act of war," his great bellow came back, defiantly. "Your Brotherhood will feel the consequences."

He turned again, and went on at a stumbling, laborious run, toward his waiting craft. Frank Enlow was beckoning, imperatively, back toward the gully.

"We must get under cover," he warned, "before it starts."

We scrambled down the steep, eroded slope, above the unfinished dam. Enlow started up the rocky bottom of the ravine, the way Cameron had fled on the day before.

"Wait!" Jane Enlow called out, eagerly. "Mr. Doyle is getting through."

She listened again, obliviously. The gaunt man looked warily back at the enormous bright nose of the cruiser, looming high above the ravine's rim, and speculatively hefted his launcher. I turned to Cameron, puzzled.

"So you've seen Doyle?"

"Last night." He watched the

girl's shining eyes, anxious for the news. "The Enlows lived just over the ridge—the first place I found. Their phone began ringing, while I was there. It was Rory Doyle. I told him about the equalizer, and he came over to help us stop Mr. Hudd."

Awed, I glanced up at the appalling pillar of the *Great Director*. "How?"

"The first two landing parties had already got in touch with the Brotherhood," Cameron explained. "They were being indoctrinated with the equalizer. The plan was to send them back, and let them spread the word among the crews. But Hudd pushed his own scheme too fast for that to succeed."

Anxiously, he watched the intent girl.

"The only way left was to try a broadcast. Not quite so good, but I think the signal crews will mostly recognize and trust Rory Doyle. It took a little time, to improvise a net of shortwave stations strong enough to reach out through the ionosphere to the other ships and the Moon."

Suddenly, the eager-faced girl slipped off her single headphone. She held it up between us, twisted a volume control, and gestured for us to listen.

"—specifications of the equalizer." Thinned and small, hoarse with a weary tension, it was the voice of Rory Doyle. "The absolute dimensions, remember, may be varied at will. It is the proportionate dimensions, and the shape and alignment of the turns, which must be precisely true.

"The safety coil, remember, must always have a greater number of turns than the primary—otherwise you have a matter bomb, instead of a power plant. The number and spacing of the secondary turns control the maximum voltage. according to the rule I gave you.

"Now, pass the word along!"

His tiny-seeming voice held a tired elation.

"Membership in the Brotherhood is open to every man of you. Now you are free to land. Mr. Hudd's ill-advised threats will be forgotten. You have nothing to fear, so long as you respect the rights of others. And now the officers of the Brotherhood wish me to say that you are welcome home."

His voice ceased. The girl took back the headphone, and her father led us up the floor of the rocky little gorge. We stopped, presently, to climb a fern-grown slope and look back across the valley.

The interstellar cruiser still towered out of the smoking forest. incredibly enormous. Nearer, the tiny pencil of Hudd's life craft stood mirror-bright upon a blackened island in the green. Between the fins of it, I saw a doll-like figure—hammering with frantic fists upon the shining valve.

"Mr. Julian Hudd," murmured Cameron, almost with pity.

We hurried on. We were crossing the low ridge, into the next valley, when the ground quivered. The jets of the cruiser made a

deafening, crushing reverberation. The bright immensity of it lifted, on a pillar of terrible fire.

Jane Enlow was listening again, as the thunder faded.

"They are going to the shore of the new Sahara Sea," she told us. "A new irrigation project—the crews can take up land, there."

An immense quiet fell upon us, after that thunder had died. I stood apart, staring into the sky, long after the living blue spark of the jets was gone. For the meaning of the equalizer was breaking slowly over me, a wave of deep emotion. It left me awed and changed and lifted, somehow strong and free.

"What happened to Mr. Hudd?" Cameron was asking.

"I don't know." Twisting at the knobs, Jane Enlow looked pale with concern for him. "The crews wouldn't let him come back on the ship. I'm afraid he was killed in the blast."

Many months had passed, however, before I learned the actual and somehow surprising fate of Mr. Julian Hudd—who had been Director general of Europe and Special Secretary of the Square-deal Machine, and who was still an adaptive and resourceful man.

The following summer, after we had all been inducted into the Brotherhood and taught the equalizer, I came back in answer to a hospitable invitation to visit the home of Frank Enlow. Already I had claimed a small homestead beside a new western sea, and friendly neighbors had helped me build the first rooms of a house there. I wanted to see Jane Enlow.

But she wasn't at home, when I arrived.

Frank Enlow, the lean ex-janitor and the last friend of Tyler, met me at the door of his pleasant home, and began to talk of Mr. Julian Hudd.

Hudd, he told me, had survived unhurt by the ion jets of the departing cruiser. He had established himself in the vacant house that had belonged to the murdered Hawkins couple. And Frank Enlow took me to see him, there.

Now a simple brother of the Brotherhood, we found Hudd plowing his young orchard. He was walking behind a small equalizer-tractor, bare to the waist and brown with sun. Sweat ran in rivulets down his dusty flanks, but his paunch and his jowls and his several chins were no longer the burdens they had been. I scarcely recognized him.

"Glad to see you, Chad." He used my first name, as always, but now his hard handclasp had a genuine cordiality. His great booming voice seemed mellowed, happy. With an air of simple, equalitarian friendship, he invited us into his home.

"Come along, Chad," he urged genially. "You'll want to see the wife. I think you'll remember her—the former Miss Jane Enlow."

THE END.

TOMORROW'S CHILDREN

BY POUL ANDERSON & F. N. WALDROP

***You** don't have to kill every man on Earth to end the human race. And atomic warfare is the way to kill hope without killing men. When* all *the children are different—*

Illustrated by Cartier.

On the world's loom
Weave the Norns doom,
Nor may they guide it nor change.
—*Wagner,* Siegfried

Ten miles up, it hardly showed. Earth was a cloudy green and brown blur, the vast vault of the stratosphere reaching changelessly out to spatial infinities, and beyond the pulsing engine there was silence and serenity no man could ever touch. Looking down, Hugh Drummond could see the Mississippi gleaming like a drawn sword, and its slow curve matched the contours shown on his map. The hills, the sea, the sun and wind and rain, they didn't change. Not in less than a million slow-striding years, and human efforts flickered too briefly in the unending night for that.

Farther down, though, and especially where cities had been— The lone man in the solitary stratojet swore softly, bitterly, and his knuckles whitened on the controls. He was a big man, his gaunt rangy form sprawling awkwardly in the tiny pressure cabin, and he wasn't quite forty. But his dark hair was streaked with gray, in the shabby flying suit his shoulders stooped, and his long homely face was drawn into haggard lines. His eyes were black-rimmed and sunken with weariness, dark and dreadful in their intensity. He'd seen too much, survived too much, until he began to look like most other people of the world. *Heir of the ages,* he thought dully.

Mechanically, he went through the motions of following his course. Natural landmarks were still there, and


EDD CARTIER

he had powerful binoculars to help him. But he didn't use them much. They showed too many broad shallow craters, their vitreous smoothness throwing back sunlight in the flat blank glitter of a snake's eye, the ground about them a churned and blasted desolation. And there were the worse regions of — deadness. Twisted dead trees, blowing sand, tumbled skeletons, perhaps at night a baleful blue glow of fluorescence. The bombs had been nightmares, riding in on wings of fire and horror to shake the planet with the death blows of cities. But the radioactive dust was worse than any nightmare.

He passed over villages, even small towns. Some of them were deserted, the blowing colloidal dust, or plague, or economic breakdown making them untenable. Others still seemed to be living a feeble half-life. Especially in the Midwest, there was a pathetic struggle to return to an agricultural system, but the insects and blights—

Drummond shrugged. After nearly two years of this, over the scarred and maimed planet, he should be used to it. The United States had been lucky. Europe, now—

Der Untergang des Abendlandes, he thought grayly. *Spengler foresaw the collapse of a topheavy civilization. He didn't foresee atomic bombs, radioactive-dust bombs, bacteria bombs, blight bombs — the bombs, the senseless inanimate bombs flying like monster insects over the shivering world. So he didn't guess the extent of the collapse.*

Deliberately he pushed the thoughts out of his conscious mind. He didn't want to dwell on them. He'd lived with them two years, and that was two eternities too long. And anyway, he was nearly home now.

The capital of the United States was below him, and he sent the stratojet slanting down in a long thunderous dive toward the mountains. Not much of a capital, the little town huddled in a valley of the Cascades, but the waters of the Potomac had filled the grave of Washington. Strictly speaking, there was no capital. The officers of the government were scattered over the country, keeping in precarious touch by plane and radio, but Taylor, Oregon, came as close to being the nerve center as any other place.

He gave the signal again on his transmitter, knowing with a faint spine-crawling sensation of the rocket batteries trained on him from the green of those mountains. When one plane could carry the end of a city, all planes were under suspicion. Not that anyone outside was supposed to know that that innocuous little town was important. But you never could tell. The war wasn't officially over. It might never be, with sheer personal survival overriding the urgency of treaties.

A light-beam transmitter gave him a cautious: "O.K. Can you land in the street?"

It was a narrow, dusty track between two wooden rows of houses, but Drummond was a good pilot and this was a good jet. "Yeah," he said. His voice had grown unused to speech.

He cut speed in a spiral descent

until he was gliding with only the faintest whisper of wind across his ship. Touching wheels to the street, he slammed on the brake and bounced to a halt.

Silence struck at him like a physical blow. The engine stilled, the sun beating down from a brassy blue sky on the drabness of rude "temporary" houses, the total-seeming desertion beneath the impassive mountains—Home! Hugh Drummond laughed, a short harsh bark with nothing of humor in it, and swung open the cockpit canopy.

There were actually quite a few people, he saw, peering from doorways and side streets. They looked fairly well fed and dressed, many in uniform, they seemed to have purpose and hope. But this, of course, was the capital of the United States of America, the world's most fortunate country.

"Get out—quick!"

The peremptory voice roused Drummond from the introspection into which those lonely months had driven him. He looked down at a gang of men in mechanics' outfits, led by a harassed-looking man in captain's uniform. "Oh—of course," he said slowly. "You want to hide the plane. And, naturally, a regular landing field would give you away."

"Hurry, get out, you infernal idiot! Anyone, *anyone* might come over and see—"

"They wouldn't get unnoticed by an efficient detection system, and you still have that," said Drummond, sliding his booted legs over the cockpit edge. "And anyway, there won't be any more raids. The war's over."

"Wish I could believe that, but who are you to say? Get a move on!"

The grease monkeys hustled the plane down the street. With an odd feeling of loneliness, Drummond watched it go. After all, it had been his home for—how long?

The machine was stopped before a false house whose whole front was swung aside. A concrete ramp led downward, and Drummond could see a cavernous immensity below. Light within it gleamed off silvery rows of aircraft.

"Pretty neat," he admitted. "Not that it matters any more. Probably it never did. Most of the hell came over on robot rockets. Oh, well." He fished his pipe from his jacket. Colonel's insignia glittered briefly as the garment flipped back.

"Oh . . . sorry, sir!" exclaimed the captain. "I didn't know—"

"'S O.K. I've gotten out of the habit of wearing a regular uniform. A lot of places I've been, an American wouldn't be very popular." Drummond stuffed tobacco into his briar, scowling. He hated to think how often he'd had to use the Colt at his hip, or even the machine guns in his plane, to save himself. He inhaled smoke gratefully. It seemed to drown out some of the bitter taste.

"General Robinson said to bring you to him when you arrived, sir," said the captain. "This way, please."

They went down the street, their boots scuffing up little acrid clouds of dust. Drummond looked sharply

about him. He'd left very shortly after the two-month Ragnarok which had tapered off when the organization of both sides broke down too far to keep on making and sending the bombs, and maintaining order with famine and disease starting their ghastly ride over the homeland. At that time, the United States was a cityless, anarchic chaos, and he'd had only the briefest of radio exchanges since then, whenever he could get at a long-range set still in working order. They'd made remarkable progress meanwhile. How much, he didn't know, but the mere existence of something like a capital was sufficient proof.

Robinson— His lined face twisted into a frown. He didn't know the man. He'd been expecting to be received by the President, who had sent him and some others out. Unless the others had— No, he was the only one who had been in eastern Europe and western Asia. He was sure of that.

Two sentries guarded the entrance to what was obviously a converted general store. But there were no more stores. There was nothing to put in them. Drummond entered the cool dimness of an antechamber. The clatter of a typewriter, the Wac operating it— He gaped and blinked. That was—impossible! Typewriters, secretaries — hadn't they gone out with the whole world, two years ago? If the Dark Ages had returned to Earth, it didn't seem—*right*—that there should still be typewriters. It didn't fit, didn't—

He grew aware that the captain had opened the inner door for him. As he stepped in, he grew aware how tired he was. His arm weighed a ton as he saluted the man behind the desk.

"At ease, at ease," Robinson's voice was genial. Despite the five stars on his shoulders, he wore no tie or coat, and his round face was smiling. Still, he looked tough and competent underneath. To run things nowadays, he'd have to be.

"Sit down, Colonel Drummond." Robinson gestured to a chair near his and the aviator collapsed into it, shivering. His haunted eyes traversed the office. It was almost well enough outfitted to be a prewar place.

Prewar! A word like a sword, cutting across history with a brutality of murder, hazing everything in the past until it was a vague golden glow through drifting, red-shot black clouds. And—only two years. *Only two years!* Surely sanity was meaningless in a world of such nightmare inversions. Why, he could barely remember Barbara and the kids. Their faces were blotted out in a tide of other visages — starved faces, dead faces, human faces become beast-formed with want and pain and eating throttled hate. His grief was lost in the agony of a world, and in some ways he had become a machine himself.

"You look plenty tired," said Robinson.

"Yeah . . . yes, sir—"

"Skip the formality. I don't go for it. We'll be working pretty close together, can't take time to be diplomatic."

"Uh-huh. I came over the North

Pole, you know. Haven't slept since— Rough time. But, if I may ask, you—" Drummond hesitated.

"I? I suppose I'm President. Ex officio, pro tem, or something. Here, you need a drink." Robinson got bottle and glasses from a drawer. The liquor gurgled out in a pungent stream. "Prewar Scotch. Till it gives out I'm laying off this modern hooch. *Gambai.*"

The fiery, smoky brew jolted Drummond to wakefulness. Its glow was pleasant in his empty stomach. He heard Robinson's voice with a surrealistic sharpness:

"Yes, I'm at the head now. My predecessors made the mistake of sticking together, and of traveling a good deal in trying to pull the country back into shape. So I think the sickness got the President, and I know it got several others. Of course, there was no means of holding an election. The armed forces had almost the only organization left, so we had to run things. Berger was in charge, but he shot himself when he learned he'd breathed radiodust. Then the command fell to me. I've been lucky."

"I see." It didn't make much difference. A few dozen more deaths weren't much, when over half the world was gone. "Do you expect to —continue lucky?" A brutally blunt question, maybe, but words weren't bombs.

"I do." Robinson was firm about that. "We've learned by experience, learned a lot. We've scattered the army, broken it into small outposts at key points throughout the country. For quite a while, we stopped travel altogether except for absolute emergencies, and then with elaborate precautions. That smothered the epidemics. The microorganisms were bred to work in crowded areas, you know. They were almost immune to known medical techniques, but without hosts and carriers they died. I guess natural bacteria ate up most of them. We still take care in traveling, but we're fairly safe now."

"Did any of the others come back? There were a lot like me, sent out to see what really had happened to the world."

"One did, from South America. Their situation is similar to ours, though they lacked our tight organization and have gone further toward anarchy. Nobody else returned but you."

It wasn't surprising. In fact, it was a cause for astonishment that anyone had come back. Drummond had volunteered after the bomb erasing St. Louis had taken his family, not expecting to survive and not caring much whether he did. Maybe that was why he had.

"You can take your time in writing a detailed report," said Robinson, "but in general, how are things over there?"

Drummond shrugged. "The war's over. Burned out. Europe has gone back to savagery. They were caught between America and Asia, and the bombs came both ways. Not many survivors, and they're starving animals. Russia, from what I saw, has managed something like you've done here, though they're worse off than we. Naturally, I couldn't find out much there. I didn't get to India

or China, but in Russia I heard rumors— No, the world's gone too far into disintegration to carry on war."

"Then we can come out in the open," said Robinson softly. "We can really start rebuilding. I don't think there'll ever be another war, Drummond. I think the memory of this one will be carved too deeply on the race for us ever to forget."

"Can you shrug it off that easily?"

"No, no, of course not. Our culture hasn't lost its continuity, but it's had a terrific setback. We'll never wholly get over it. But—we're on our way up again."

The general rose, glancing at his watch. "Six o'clock. Come on, Drummond, let's get home."

"Home?"

"Yes, you'll stay with me. Man, you look like the original zombie. You'll need a month or more of sleeping between clean sheets, of home cooking and home atmosphere. My wife will be glad to have you; we see almost no new faces. And as long as we'll work together, I'd like to keep you handy. The shortage of competent men is terrific."

They went down the street, an aide following. Drummond was again conscious of the weariness aching in every bone and fiber of him. A home — after two years of ghost towns, of shattered chimneys above blood-dappled snow, of flimsy leantos housing starvation and death.

"Your plane will be mighty useful, too," said Robinson. "Those atomic-powered craft are scarcer than hens' teeth used to be." He chuckled hollowly, as at a rather grim joke. "Got you through close to two years of flying without needing fuel. Any other trouble?"

"Some, but there were enough spare parts." No need to tell of those frantic hours and days of slaving, of desperate improvisation with hunger and plague stalking him who stayed overlong. He'd had his troubles getting food, too, despite the plentiful supplies he'd started out with. He'd fought for scraps in the winters, beaten off howling maniacs who would have killed him for a bird he'd shot or a dead horse he'd scavenged. He hated that plundering, and would not have cared personally if they'd managed to destroy him. But he had a mission, and the mission was all he'd had left as a focal point for his life, so he'd clung to it with fanatic intensity.

And now the job was over, and he realized he couldn't rest. He didn't dare. Rest would give him time to remember. Maybe he could find surcease in the gigantic work of reconstruction. Maybe.

"Here we are," said Robinson.

Drummond blinked in new amazement. There was a car, camouflaged under brush, with a military chauffeur — *a car!* And in pretty fair shape, too.

"We've got a few oil wells going again, and a small patched-up refinery," explained the general. "It furnishes enough gas and oil for what traffic we have."

They got in the rear seat. The aide sat in front, a rifle ready. The car started down a mountain road.

"Where to?" asked Drummond a little dazedly.

Robinson smiled. "Personally," he said, "I'm almost the only lucky man on Earth. We had a summer cottage on Lake Taylor, a few miles from here. My wife was there when the war came, and stayed, and nobody came along till I brought the head offices here with me. Now I've got a home all to myself."

"Yeah. Yeah, you're lucky," said Drummond. He looked out the window, not seeing the sun-spattered woods. Presently he asked, his voice a little harsh: "How is the country really doing now?"

"For a while it was rough. Damn rough. When the cities went, our transportation, communication, and distribution systems broke down. In fact, our whole economy disintegrated, though not all at once. Then there was the dust and the plagues. People fled, and there was open fighting when overcrowded safe places refused to take in any more refugees. Police went with the cities, and the army couldn't do much patrolling. We were busy fighting the enemy troops that'd flown over the Pole to invade. We still haven't gotten them all. Bands are roaming the country, hungry and desperate outlaws, and there are plenty of Americans who turned to banditry when everything else failed. That's why we have this guard, though so far none have come this way.

"The insect and blight weapons just about wiped out our crops, and that winter everybody starved. We checked the pests with modern methods, though it was touch and go for a while, and next year got some food. Of course, with no distribution as yet, we failed to save a lot of people. And farming is still a tough proposition. We won't really have the bugs licked for a long time. If we had a research center as well equipped as those which produced the things—But we're gaining. We're gaining."

"Distribution—" Drummond rubbed his chin. "How about railroads? Horse-drawn vehicles?"

"We have some railroads going, but the enemy was as careful to dust most of ours as we were to dust theirs. As for horses, they were nearly all eaten that first winter. I know personally of only a dozen. They're on my place; I'm trying to breed enough to be of use, but"—Robinson smiled wryly—"by the time we've raised that many, the factories should have been going quite a spell."

"And so now—?"

"We're over the worst. Except for outlaws, we have the population fairly well controlled. The civilized people are fairly well fed, with some kind of housing. We have machine shops, small factories, and the like going, enough to keep our transportation and other mechanism 'level.' Presently we'll be able to expand these, begin actually increasing what we have. In another five years or so, I guess, we'll be integrated enough to drop martial law and hold a general election. A big job ahead, but a good one."

The car halted to let a cow lumber over the road, a calf trotting at her heels. She was gaunt and shaggy, and skittered nervously from the vehicle into the brush.

"Wild," explained Robinson. "Most of the real wild life was killed off for food in the last two years, but a lot of farm animals escaped when their owners died or fled, and have run free ever since. They—" He noticed Drummond's fixed gaze. The pilot was looking at the calf. Its legs were half the normal length.

"Mutant," said the general. "You find a lot such animals. Radiation from bombed or dusted areas. There are even a lot of human abnormal births." He scowled, worry clouding his eyes. "In fact, that's just about our worst problem. It—"

The car came out of the woods onto the shore of a small lake. It was a peaceful scene, the quiet waters like molten gold in the slanting sunlight, trees ringing the circumference and all about them the mountains. Under one huge pine stood a cottage, a woman on the porch.

It was like one summer with Barbara—Drummond cursed under his breath and followed Robinson toward the little building. It wasn't, it wasn't, it could never be. Not ever again. There were soldiers guarding this place from chance marauders, and— There was an odd-looking flower at his foot. A daisy, but huge and red and irregularly formed.

A squirrel chittered from a tree. Drummond saw that its face was so blunt as to be almost human.

Then he was on the porch, and Robinson was introducing him to "my wife Elaine." She was a nice-looking young woman with eyes that were sympathetic on Drummond's exhausted face. The aviator tried not to notice that she was pregnant.

He was led inside, and reveled in a hot bath. Afterward there was supper, but he was numb with sleep by then, and hardly noticed it when Robinson put him to bed.

Reaction set in, and for a week or so Drummond went about in a haze, not much good to himself or anyone else. But it was surprising what

plenty of food and sleep could do, and one evening Robinson came home to find him scribbling on sheets of paper.

"Arranging my notes and so on," he explained. "I'll write out the complete report in a month, I guess."

"Good. But no hurry." Robinson settled tiredly into an armchair. "The rest of the world will keep. I'd rather you'd just work at this off and on, and join my staff for your main job."

"O.K. Only what'll I do?"

"Everything. Specialization is gone; too few surviving specialists and equipment. I think your chief task will be to head the census bureau."

"Eh?"

Robinson grinned lopsidedly. "You'll *be* the census bureau, except for what few assistants I can spare you." He leaned forward, said earnestly: "And it's one of the most important jobs there is. You'll do for this country what you did for central Eurasia, only in much greater detail. Drummond, we have to *know*."

He took a map from a desk drawer and spread it out. "Look, here's the United States. I've marked regions known to be uninhabitable in red." His fingers traced out the ugly splotches. "Too many of 'em, and doubtless there are others we haven't found yet. Now, the blue X's are army posts." They were sparsely scattered over the land, near the centers of population groupings. "Not enough of those. It's all we can do to control the more or less well-off, orderly people. Bandits, enemy troops, homeless refugees — they're still running wild, skulking in the backwoods and barrens, and raiding whenever they can. And they spread the plague. We won't really have it licked till everybody's settled down, and that'd be hard to enforce. Drummond, we don't even have enough soldiers to start a feudal system for protection. The plague spread like a prairie fire in those concentrations of men.

"We have to *know*. We have to know how many people survived—half the population, a third, a quarter, whatever it is. We have to know where they are, and how they're fixed for supplies, so we can start up an equitable distribution system. We have to find all the small-town shops and labs and libraries still standing, and rescue their priceless contents before looters or the weather beat us to it. We have to locate doctors and engineers and other professional men, and put them to work rebuilding. We have to find the outlaws and round them up. We— I could go on forever. Once we have all that information, we can set up a master plan for redistributing population, agriculture, industry, and the rest most efficiently, for getting the country back under civil authority and police, for opening regular transportation and communication channels—for getting the nation back on its feet."

"I see," nodded Drummond. "Hitherto, just surviving and hanging on to what was left has taken precedence. Now you're in a position to start expanding, *if* you know where and how much to expand."

"Exactly." Robinson rolled a cig-

arette, grimacing. "Not much tobacco left. What I have is perfectly foul. Lord, that war was crazy!"

"All wars are," said Drummond dispassionately, "but technology advanced to the point of giving us a knife to cut our throats with. Before that, we were just beating our heads against the wall. Robinson, we can't go back to the old ways. We've *got* to start on a new track—a track of sanity."

"Yes. And that brings up—" The other man looked toward the kitchen door. They could hear the cheerful rattle of dishes there, and smell mouth-watering cooking odors. He lowered his voice. "I might as well tell you this now, but don't let Elaine know. She . . . she shouldn't be worried. Drummond, did you see our horses?"

"The other day, yes. The colts—"

"Uh-huh. There've been five colts born of eleven mares in the last year. Two of them were so deformed they died in a week, another in a few months. One of the two left has cloven hoofs and almost no teeth. The last one looks normal—so far. One out of eleven, Drummond."

"Were those horses near a radioactive area?"

"They must have been. They were rounded up wherever found and brought here. The stallion was caught near the site of Portland, I know. But if he were the only one with mutated genes, it would hardly show in the first generation, would it? I understand nearly all mutations are Mendelian recessives. Even if there were one dominant, it would show in all the colts, but none of these looked alike."

"Hm-m-m—I don't know much about genetics, but I do know hard radiation, or rather the secondary charged particles it produces, will cause mutation. Only mutants are rare, and tend to fall into certain patterns—"

"*Were* rare!" Suddenly Robinson was grim, something coldly frightened in his eyes. "Haven't you noticed the animals and plants? They're fewer than formerly, and . . . well, I've not kept count, but at least half those seen or killed have something wrong, internally or externally."

Drummond drew heavily on his pipe. He needed something to hang onto, in a new storm of insanity. Very quietly, he said:

"In my college biology course, they told me the vast majority of mutations are unfavorable. More ways of not doing something than of doing it. Radiation might sterilize an animal, or might produce several degrees of genetic change. You could have a mutation so violently lethal the possessor never gets born, or soon dies. You could have all kinds of more or less handicapping factors, or just random changes not making much difference one way or the other. Or in a few rare cases you might get something actually favorable, but you couldn't really say the possessor is a true member of the species. And favorable mutations themselves usually involve a price in the partial or total loss of some other function.

"Right." Robinson nodded heavily. "One of your jobs on the census will be to try and locate any and all who know genetics, and send them here. But your real task, which only you and I and a couple of others must know about, the job overriding all other considerations, will be to find the human mutants."

Drummond's throat was dry. "There've been a lot of them?" he whispered.

"Yes. But we don't know how many or where. We only know about those people who live near an army post, or have some other fairly regular intercourse with us, and they're only a few thousand all told. Among them, the birth rate has gone down to about half the prewar ratio. And over half the births they do have are abnormal."

"*Over half—*"

"Yeah. Of course, the violently different ones soon die, or are put in an institution we've set up in the Alleghenies. But what can we do with viable forms, if their parents still love them? A kid with deformed or missing or abortive organs, twisted internal structure, a tail, or something even worse . . . well, *it'll* have a tough time in life, but it can generally survive. And perpetuate itself—"

"And a normal-looking one might have some unnoticeable quirk, or a characteristic that won't show up for years. Or even a normal one might be carrying recessives, and pass them on— God!" The exclamation was half blasphemy, half prayer. "But how'd it happen? People weren't all near atom-hit areas."

"Maybe not, though a lot of survivors escaped from the outskirts. But there was that first year, with everybody on the move. One could pass near enough to a blasted region to be affected, without knowing it. And that damnable radiodust, blowing on the wind. It's got a long half-life. It'll be active for decades. Then, as in any collapsing culture, promiscuity was common. Still is. Oh, it'd spread itself, all right."

"I still don't see why it spread itself so much. Even here—"

"Well, I don't know why it shows up here. I suppose a lot of the local flora and fauna came in from elsewhere. This place is safe. The nearest dusted region is three hundred miles off, with mountains between. There must be many such islands of comparatively normal conditions. We have to find them too. But elsewhere—"

"Soup's on," announced Elaine, and went from the kitchen to the dining room with a loaded tray.

The men rose. Grayly, Drummond looked at Robinson and said tonelessly: "O.K. I'll get your information for you. We'll map mutation areas and safe areas, we'll check on our population and resources, we'll eventually get all the facts you want. But — what are you going to do then?"

"I wish I knew," said Robinson haggardly. "I wish I knew."

Winter lay heavily on the north, a vast gray sky seeming frozen solid over the rolling white plains. The

last three winters had come early and stayed long. Dust, colloidal dust of the bombs, suspended in the atmosphere and cutting down the solar constant by a deadly percent or two. There had even been a few earthquakes, set off in geologically unstable parts of the world by bombs planted right. Half California had been ruined when a sabotage bomb started the San Andreas Fault on a major slip. And that kicked up still more dust.

Fimbulwinter, thought Drummond bleakly. *The doom of the prophecy. But no, we're surviving. Though maybe not as men—*

Most people had gone south, and there overcrowding had made starvation and disease and internecine struggle the normal aspects of life. Those who'd stuck it out up here, and had luck with their pest-ridden crops, were better off.

Drummond's jet slid above the cratered black ruin of the Twin Cities. There was still enough radioactivity to melt the snow, and the pit was like a skull's empty eye socket. The man sighed, but he was becoming calloused to the sight of death. There was so much of it. Only the struggling agony of life mattered any more.

He strained through the sinister twilight, swooping low over the unending fields. Burned-out hulks of farmhouses, bones of ghost towns, sere deadness of dusted land — but he'd heard travelers speak of a fairly powerful community up near the Canadian border, and it was up to him to find it.

A lot of things had been up to him in the last six months. He'd had to work out a means of search, and organize his few, overworked assistants into an efficient staff, and go out on the long hunt.

They hadn't covered the country. That was impossible. Their few planes had gone to areas chosen more or less at random, trying to get a cross section of conditions. They'd penetrated wildernesses of hill and plain and forest, establishing contact with scattered, still demoralized outdwellers. On the whole, it was more laborious than anything else. Most were pathetically glad to see any symbol of law and order and the paradisical-seeming "old days." Now and then there was danger and trouble, when they encountered wary or sullen or outright hostile groups suspicious of a government they associated with disaster, and once there had even been a pitched battle with roving outlaws. But the work had gone ahead, and now the preliminaries were about over.

Preliminaries— It was a bigger job to find out exactly how matters stood than the entire country was capable of undertaking right now. But Drummond had enough facts for reliable extrapolation. He and his staff had collected most of the essential data and begun correlating it. By questioning, by observation, by seeking and finding, by any means that came to hand they'd filled their notebooks. And in the sketchy outlines of a Chinese drawing, and with the same stark realism, the truth was there.

Just this one more place, and I'll go home, thought Drummond for the

—thousandth?—time. His brain was getting into a rut, treading the same terrible circle and finding no way out. *Robinson won't like what I tell him, but there it is.* And darkly, slowly: *Barbara, maybe it was best you and the kids went as you did. Quickly, cleanly, not even knowing it. This isn't much of a world. It'll never be our world again.*

He saw the place he sought, a huddle of buildings near the frozen shores of the Lake of the Woods, and his jet murmured toward the white ground. The stories he'd heard of this town weren't overly encouraging, but he supposed he'd get out all right. The others had his data anyway, so it didn't matter.

By the time he'd landed in the clearing just outside the village, using the jet's skis, most of the inhabitants were there waiting. In the gathering dusk they were a ragged and wild-looking bunch, clumsily dressed in whatever scraps of cloth and leather they had. The bearded, hard-eyed men were armed with clubs and knives and a few guns. As Drumond got out, he was careful to keep his hands away from his own automatics.

"Hello," he said. "I'm friendly."

"Y' better be," growled the big leader. "Who are you, where from, an' why?"

"First," lied Drummond smoothly, "I want to tell you I have another man with a plane who knows where I am. If I'm not back in a certain time, he'll come with bombs. But we don't intend any harm or interference. This is just a sort of social call. I'm Hugh Drummond of the United States Army."

They digested that slowly. Clearly, they weren't friendly to the government, but they stood in too much awe of aircraft and armament to be openly hostile. The leader spat. "How long you staying?"

"Just overnight, if you'll put me up. I'll pay for it." He held up a small pouch. "Tobacco."

Their eyes gleamed, and the leader said, "You'll stay with me. Come on."

Drummond gave him the bribe and went with the group. He didn't like to spend such priceless luxuries thus freely, but the job was more important. And the boss seemed thawed a little by the fragrant brown flakes. He was sniffing them greedily.

"Been smoking bark an' grass," he confided. "Terrible."

"Worse than that," agreed Drummond. He turned up his jacket collar and shivered. The wind starting to blow was bitterly cold.

"Just what y' here for?" demanded someone else.

"Well, just to see how things stand. We've got the government started again, and are patching things up. But we have to know where folks are, what they need, and so on."

"Don't want nothing t' do with the gov'ment," muttered a woman. "They brung all this on us."

"Oh, come now. We didn't ask to be attacked." Mentally, Drummond crossed his fingers. He neither knew nor cared who was to blame. Both sides, letting mutual fear and friction mount to hysteria— In fact, he wasn't sure the United States hadn't

sent out the first rockets, on orders of some panicky or aggressive officials. Nobody was alive who admitted knowing.

"It's the jedgment o' God, for the sins o' our leaders," persisted the woman. "The plague, the fire-death, all that, ain't it foretold in the Bible? Ain't we living in the last days o' the world?"

"Maybe." Drummond was gald to stop before a long low cabin. Religious argument was touchy at best, and with a lot of people nowadays it was dynamite.

They entered the rudely furnished but fairly comfortable structure. A good many crowded in with them. For all their suspicion, they were curious, and an outsider in an aircraft was a blue-moon event these days.

Drummond's eyes flickered unobtrusively about the room, noticing details. Three women — that meant a return to concubinage. Only to be expected in a day of few men and strong-arm rule. Ornaments and utensils, tools and weapons of good quality—yes, that confirmed the stories. This wasn't exactly a bandit town, but it had waylaid travelers and raided other places when times were hard, and built up a sort of dominance of the surrounding country. That, too, was common.

There was a dog on the floor nursing a litter. Only three pups, and one of those was bald, one lacked ears, and one had more toes than it should. Among the wide-eyed children present, there were several two years old or less, and with almost no obvious exceptions, they were also different.

Drummond sighed heavily and sat down. In a way, this clinched it. He'd known for a long time, and finding mutation here, as far as any place from atomic destruction, was about the last evidence he needed.

He had to get on friendly terms, or he wouldn't find out much about things like population, food production, and whatever else there was to know. Forcing a smile to stiff lips, he took a flask from his jacket. "Prewar rye," he said. "Who wants a nip?"

"Do we!" The answer barked out in a dozen voices and words. The flask circulated, men pawing and cursing and grabbing to get at it. *Their homebrew must be pretty bad,* thought Drummond wryly.

The chief shouted an order, and one of his women got busy at the primitive stove. "Rustle you a mess o' chow," he said heartily. "An' my name's Sam Buckman."

"Pleased to meet you, Sam." Drummond squeezed the hairy paw hard. He had to show he wasn't a weakling, a conniving city slicker.

"What's it like, outside?" asked someone presently. "We ain't heard for so long—"

"You haven't missed much," said Drummond between bites. The food was pretty good. Briefly, he sketched conditions. "You're better off than most," he finished.

"Yeah. Mebbe so." Sam Buckman scratched his tangled beard. "What I'd give f'r a razor blade—! It ain't easy, though. The first year we weren't no better off 'n anyone

else. Me, I'm a farmer, I kept some ears o' corn an' a little wheat an' barley in my pockets all that winter, even though I was starving. A bunch o' hungry refugees plundered my place, but I got away an' drifted up here. Next year I took an empty farm here an' started over."

Drummond doubted that it had been abandoned, but said nothing. Sheer survival outweighed a lot of considerations.

"Others came an' settled here," said the leader reminiscently. "We farm together. We have to; one man couldn't live by hisself, not with the bugs an' blight, an' the crops sproutin' into all new kinds, an' the outlaws aroun'. Not many up here, though we did beat off some enemy troops last winter." He glowed with pride at that, but Drummond wasn't particularly impressed. A handful of freezing starveling conscripts, lost and bewildered in a foreign enemy's land, with no hope of ever getting home, weren't formidable.

"Things getting better, though," said Buckman. "We're heading up." He scowled blackly, and a palpable chill crept into the room. "If 'twern't for the births—"

"Yes—the births! The new babies. Even the stock an' plants." It was an old man speaking, his eyes glazed with near madness. "It's the mark o' the beast. Satan is loose in the world—"

"Shut up!" Huge and bristling with wrath, Buckman launched himself out of his seat and grabbed the oldster by his scrawny throat. "Shut up 'r I'll bash y'r lying head in. Ain't no son o' mine being marked by the devil."

"Or mine—" "Or mine—" The rumble of voices ran about the cabin, sullen and afraid.

"It's God's jedgment, I tell you!" The woman was shrilling again. "The end o' the world is near. Prepare f'r the second coming—"

"An' you shut up too, Mag Schmidt," snarled Buckman. He stood bent over, gnarled arms swinging loose, hands flexing, little eyes darting red and wild about the room. "Shut y'r trap an' keep it shut. I'm still boss here, an' if you don't like it you can get out. I still don't think that funny-looking brat o' y'rs fell in the lake by accident."

The woman shrank back, lips tight. The room filled with a crackling silence. One of the babies began to cry. It had two heads.

Slowly and heavily, Buckman turned to Drummond, who sat immobile against the wall. "You see?" he asked dully. "You see how it is? Maybe it is the curse o' God. Maybe the world is ending. I dunno. I just know there's few enough babies, an' most o' them *de*formed. Will it go on? Will all our kids be monsters? Should we . . . kill these an' hope we get some human babies? What is it? What to do?"

Drummond rose. He felt a weight as of centuries on his shoulders, the weariness, blank and absolute, of having seen that smoldering panic and heard that desperate appeal too often, too often.

"Don't kill them," he said. "That's the worst kind of murder, and anyway it'd do no good at all. It comes

from the bombs, and you can't stop it. You'll go right on having such children, so you might as well get used to it."

By atomic-powered stratojet it wasn't far from Minnesota to Oregon, and Drummond landed in Taylor about noon the next day. This time there was no hurry to get his machine under cover, and up on the mountain was a raw scar of earth where a new airfield was slowly being built. Men were getting over their terror of the sky. They had another fear to face now, and it was one from which there was no hiding.

Drummond walked slowly down the icy main street to the central office. It was numbingly cold, a still, relentless intensity of frost eating through clothes and flesh and bone. It wasn't much better inside. Heating systems were still poor improvisations.

"You're back!" Robinson met him in the antechamber, suddenly galvanized with eagerness. He had grown thin and nervous, looking ten years older, but impatience blazed from him. "How is it? How is it?"

Drummond held up a bulky notebook. "All here," he said grimly. "All the facts we'll need. Not formally correlated yet, but the picture is simple enough."

Robinson laid an arm on his shoulder and steered him into the office. He felt the general's hand shaking, but he'd sat down and had a drink before business came up again.

"You've done a good job," said the leader warmly. "When the country's organized again, I'll see you get

a medal for this. Your men in the other planes aren't in yet."

"No, they'll be gathering data for a long time. The job won't be finished for years. I've only got a general outline here, but it's enough. It's enough." Drummond's eyes were haunted again.

Robinson felt cold at meeting that too-steady gaze. He whispered shakily: "Is it—bad?"

"The worst. Physically, the country's recovering. But biologically, we've reached a crossroads and taken the wrong fork."

"What do you mean? *What do you mean?*"

Drummond let him have it then, straight and hard as a bayonet thrust. "The birth rate's a little over half the prewar," he said, "and about seventy-five per cent of all births are mutant, of which possibly two-thirds are viable and presumably fertile. Of course, that doesn't include late-maturing characteristics, or those undetectable by naked-eye observation, or the mutated recessive genes that must be carried by a lot of otherwise normal zygotes. And it's everywhere. There are no safe places."

"I see," said Robinson after a long time. He nodded, like a man struck a stunning blow and not yet fully aware of it. "I see. The reason—"

"Is obvious."

"Yes. People going through radioactive areas—"

"Why, no. That would only account for a few. But—"

"No matter. The fact's there, and that's enough. We have to decide what to do about it."

"And soon." Drummond's jaw set. "It's wrecking our culture. We at least preserved our historical continuity, but even that's going now. People are going crazy as birth after birth is monstrous. Fear of the unknown, striking at minds still stunned by the war and its immediate aftermath. Frustration of parenthood, perhaps the most basic instinct there is. It's leading to infanticide, desertion, despair, a cancer at the root of society. We've got to act."

"How? How?" Robinson stared numbly at his hands.

"I don't know. You're the leader. Maybe an educational campaign, though that hardly seems practicable. Maybe an acceleration of your program for re-integrating the country. Maybe— I don't know."

Drummond stuffed tobacco into his pipe. He was near the end of what he had, but would rather take a few good smokes than a lot of niggling puffs. "Of course," he said thoughtfully, "it's probably not the end of things. We won't know for a generation or more, but I rather imagine the mutants can grow into society. They'd better, for they'll outnumber the humans. The thing is, if we just let matters drift there's no telling where they'll go. The situation is unprecedented. We may end up in a culture of specialized variations, which would be very bad from an evolutionary standpoint. There may be fighting between mutant types, or with humans. Interbreeding may produce worse freaks, particularly when accumulated recessives start showing up. Robinson, if we want any say at all in what's

going to happen in the next few centuries, we have to act quickly. Otherwise it'll snowball out of all control."

"Yes. Yes, we'll have to act fast. And hard." Robinson straightened in his chair. Decision firmed his countenance, but his eyes were staring. "We're mobilized," he said. "We have the men and the weapons and the organization. They won't be able to resist."

The ashy cold of Drummond's emotions stirred, but it was with a horrible wrenching of fear. "What are you getting at?" he snapped.

"Racial death. All mutants and their parents to be sterilized whenever and wherever detected."

"You're crazy!" Drummond sprang from his chair, grabbed Robinson's shoulders across the desk, and shook him. "You . . . why, it's impossible! You'll bring revolt, civil war, final collapse!"

"Not if we go about it right." There were little beads of sweat studding the general's forehead. "I don't like it any better than you, but it's got to be done or the human race is finished. Normal births a minority—" He surged to his feet, gasping. "I've thought a long time about this. Your facts only confirmed my suspicions. This tears it. Can't you see? Evolution has to proceed slowly. Life wasn't meant for such a storm of change. Unless we can save the true human stock, it'll be absorbed and differentiation will continue till humanity is a collection of freaks, probably intersterile. Or . . . there must be a lot of lethal recessives. In a large population, they can accumulate unnoticed till nearly everybody has them, and then start emerging all at once. That'd wipe us out. It's happened before, in rats and other species. If we eliminate mutant stock now, we can still save the race. It won't be cruel. We have sterilization techniques which are quick and painless, not upsetting the endocrine balance. But it's got to be done." His voice rose to a raw scream, broke. "It's got to be done!"

Drummond slapped him, hard. He drew a shuddering breath, sat down, and began to cry, and somehow that was the most horrible sight of all.

"You're crazy," said the aviator. "You've gone nuts with brooding alone on this the last six months, without knowing or being able to act. You've lost all perspective.

"We can't use violence. In the first place, it would break our tottering, cracked culture irreparably, into a mad-dog finish fight. We'd not even win it. We're outnumbered, and we couldn't hold down a continent, eventually a planet. And remember what we said once, about abandoning the old savage way of settling things, that never brings a real settlement at all? We'd throw away a lesson our noses were rubbed in not three years ago. We'd return to the beast—to ultimate extinction.

"And anyway," he went on very quietly, "it wouldn't do a bit of good. Mutants would still be born. The poison is everywhere. Normal parents will give birth to mutants, somewhere along the line. We just have to accept that fact, and live with it. The *new* human race will have to."

"I'm sorry." Robinson raised his face from his hands. It was a ghastly visage, gone white and old, but there was calm on it. "I—blew my top. You're right. I've been thinking of this, worrying and wondering, living and breathing it, lying awake nights, and when I finally sleep I dream of it. I . . . yes, I see your point. And you're right."

"It's O.K. You've been under a terrific strain. Three years with never a rest, and the responsibility for a nation, and now this— Sure, everybody's entitled to be a little crazy. We'll work out a solution, somehow."

"Yes, of course." Robinson poured out two stiff drinks and gulped his. He paced restlessly, and his tremendous ability came back in waves of strength and confidence. "Let me see— Eugenics, of course. If we work hard, we'll have the nation tightly organized inside of ten years. Then . . . well, I don't suppose we can keep the mutants from interbreeding, but certainly we can pass laws to protect humans and encourage their propagation. Since radical mutations would probably be intersterile anyway, and most mutants handicapped one way or another, a few generations should see humans completely dominant again."

Drummond scowled. He was worried. It wasn't like Robinson to be unreasonable. Somehow, the man had acquired a mental blind spot where this most ultimate of human problems was concerned. He said slowly, "That won't work either. First, it'd be hard to impose and enforce. Second, we'd be repeating the old *Herrenvolk* notion. Mutants are inferior, mutants must be kept in their place—to enforce that, especially on a majority, you'd need a full-fledged totalitarian state. Third, that wouldn't work either, for the rest of the world, with almost no exceptions, is under no such control and we'll be in no position to take over that control for a long time—generations. Before then, mutants will dominate everywhere over there, and if they resent the way we treat their kind here, we'd better run for cover."

"You assume a lot. How do you know those hundreds or thousands of diverse types will work together? They're less like each other than like humans, even. They could be played off against each other."

"Maybe. But *that* would be going back onto the old road of treachery and violence, the road to Hell. Conversely, if every not-quite-human is called a 'mutant', like a separate class, he'll think he is, and act accordingly against the lumped-together 'humans'. No, the only way to sanity —to *survival*— is to abandon class prejudice and race hate altogether, and work as individuals. We're all . . . well, Earthlings, and subclassification is deadly. We all have to live together, and might as well make the best of it."

"Yeah . . . yeah, that's right too."

"Anyway, I repeat that all such attempts would be useless. All Earth is infected with mutation. It will be for a long time. The purest human stock will still produce mutants."

"Y-yes, that's true. Our best bet seems to be to find all such stock

and withdraw it into the few safe areas left. It'll mean a small human population, but a *human* one."

"I tell you, that's impossible," clipped Drummond. "There is no safe place. Not one."

Robinson stopped pacing and looked at him as at a physical antagonist. "That so?" he almost growled. "Why?"

Drummond told him, adding incredulously, "Surely you knew that. Your physicists must have measured the amount of it. Your doctors, your engineers, that geneticist I dug up for you. You obviously got a lot of this biological information you've been slinging at me from him. They *must* all have told you the same thing."

Robinson shook his head stubbornly. "It can't be. It's not reasonable. The concentration wouldn't be great enough."

"Why, you poor fool, you need only look around you. The plants, the animals— Haven't there been any births in Taylor?"

"No. This is still a man's town, though women are trickling in and several babies are on the way—" Robinson's face was suddenly twisted with desperation. "Elaine's is due any time now. She's in the hospital here. Don't you see, our other kid died of the plague. This one's all we have. We want him to grow up in a world free of want and fear, a world of peace and sanity where he can play and laugh and become a man, not a beast starving in a cave. You and I are on our way out. We're the old generation, the one that wrecked the world. It's up to us to build it again, and then retire from it to let our children have it. The future's theirs. We've got to make it ready for them."

Sudden insight held Drummond motionless for long seconds. Understanding came, and pity, and an odd gentleness that changed his sunken bony face. "Yes," he murmured, "yes, I see. That's why you're working with all that's in you to build a normal, healthy world. That's why you nearly went crazy when this threat appeared. That . . . that's why you can't, just can't comprehend—"

He took the other man's arm and guided him toward the door. "Come on," he said. "Let's go see how your wife's making out. Maybe we can get her some flowers on the way."

The silent cold bit at them as they went down the street. Snow crackled underfoot. It was already grimy with town smoke and dust, but overhead the sky was incredibly clean and blue. Breath smoked whitely from their mouths and nostrils. The sound of men at work rebuilding drifted faintly between the bulking mountains.

"We couldn't emigrate to another planet, could we?" asked Robinson, and answered himself: "No, we lack the organization and resources to settle them right now. We'll have to make out on Earth. A few safe spots—there *must* be others besides this one—to house the true humans till the mutation period is over. Yes, we can do it."

"There are no safe places," insisted Drummond. "Even if there

were, the mutants would still outnumber us. Does your geneticist have any idea how this'll come out, biologically speaking?"

"He doesn't know. His specialty is still largely unknown. He can make an intelligent guess, and that's all."

"Yeah. Anyway, our problem is to learn to live with the mutants, to accept anyone as—Earthling—no matter how he looks, to quit thinking anything was ever settled by violence or connivance, to build a culture of individual sanity. Funny," mused Drummond, "how the impractical virtues, tolerance and sympathy and generosity, have become the fundamental necessities of simple survival. I guess it was always true, but it took the death of half the world and the end of a biological era to make us see that simple little fact. The job's terrific. . We've got half a million years of brutality and greed, superstition and prejudice, to lick in a few generations. If we fail, mankind is done. But we've got to try."

They found some flowers, potted in a house, and Robinson bought them with the last of his tobacco. By the time he reached the hospital, he was sweating. The sweat froze on his face as he walked.

The hospital was the town's biggest building, and fairly well equipped. A nurse met them as they entered.

"I was just going to send for you, General Robinson," she said. "The baby's on the way."

"How . . . is she?"

"Fine, so far. Just wait here, please."

Drummond sank into a chair and with haggard eyes watched Robinson's jerky pacing. *The poor guy. Why is it expectant fathers are supposed to be so funny? It's like laughing at a man on the rack. I know, Barbara, I know.*

"They have some anaesthetics," muttered the general. "They . . . Elaine never was very strong."

"She'll be all right." *It's afterward that worries me.*

"Yeah— Yeah— How long, though, how long?"

"Depends. Take it easy." With a wrench, Drummond made a sacrifice to a man he liked. He filled his pipe and handed it over. "Here, you need a smoke."

"Thanks." Robinson puffed raggedly.

The slow minutes passed, and Drummond wondered vaguely what he'd do when—it—happened. It didn't have to happen. But the chances were all against such an easy solution. He was no psychologist. Best just to let things happen as they would.

The waiting broke at last. A doctor came out, seeming an inscrutable high priest in his white garments. Robinson stood before him, motionless.

"You're a brave man," said the doctor. His face, as he removed the mask, was stern and set. "You'll need your courage."

"She—" It was hardly a human sound, that croak.

"Your wife is doing well. But the baby—"

A nurse brought out the little wailing form. It was a boy. But his

limbs were rubbery tentacles terminating in boneless digits.

Robinson looked, and something went out of him as he stood there. When he turned, his face was dead.

"You're lucky," said Drummond, and meant it. He'd seen too many other mutants. "After all, if he can use those hands he'll get along all right. He'll even have an advantage in certain types of work. It isn't a deformity, really. If there's nothing else, you've got a good kid."

"*If!* You can't tell with mutants."

"I know. But you've got guts, you and Elaine. You'll see this through, together." Briefly, Drummond felt an utter personal desolation. He went on, perhaps to cover that emptiness:

"I see why you didn't understand the problem. You *wouldn't*. It was a psychological bloc, suppressing a fact you didn't dare face. That boy is really the center of your life. You couldn't think the truth about him, so your subconscious just refused to let you think rationally on that subject at all.

"Now you know. Now you realize there's no safe place, not on all the planet. The tremendous incidence of mutant births in the first generation could have told you that alone. Most such new characteristics are recessive, which means both parents have to have it for it to show in the zygote. But genetic changes are random, except for a tendency to fall into roughly similar patterns. Four-leaved clovers, for instance. Think how vast the total number of such changes must be, to produce so many corresponding changes in a couple of years. Think how many, *many* recessives there must be, existing only in gene patterns till their mates show up. We'll just have to take our chances of something really deadly accumulating. We'd never know till too late."

"The dust—"

"Yeah. The radiodust. It's colloidal, and uncountable other radiocolloids were formed when the bombs went off, and ordinary dirt gets into unstable isotopic forms near the craters. And there are radiogases too, probably. The poison is all over the world by now, spread by wind and air currents. Colloids can be suspended indefinitely in the atmosphere.

"The concentration isn't too high for life, though a physicist told me he'd measured it as being very near the safe limit and there'll probably be a lot of cancer. But it's everywhere. Every breath we draw, every crumb we eat and drop we drink, every clod we walk on, the dust is there. It's in the stratosphere, clear on down to the surface, probably a good distance below. We could only escape by sealing ourselves in air-conditioned vaults and wearing spacesuits whenever we got out, and under present conditions that's impossible.

"Mutations were rare before, because a charged particle has to get pretty close to a gene and be moving fast before its electromagnetic effect causes physico-chemical changes, and then that particular chromosome has to enter into reproduction. Now the charged particles, and the gamma rays producing still more, are every-

where. "Even at the comparatively low concentration, the odds favor a given organism having so many cells changed that at least one will give rise to a mutant. There's even a good chance of like recessives meeting in the first generation, as we've seen. Nobody's safe, no place is free."

"The geneticist thinks some true humans will continue."

"A few, probably. After all, the radioactivity isn't too concentrated, and it's burning itself out. But it'll take fifty or a hundred years for the process to drop to insignificance, and by then the pure stock will be way in the minority. And there'll still be all those unmatched recessives, waiting to show up."

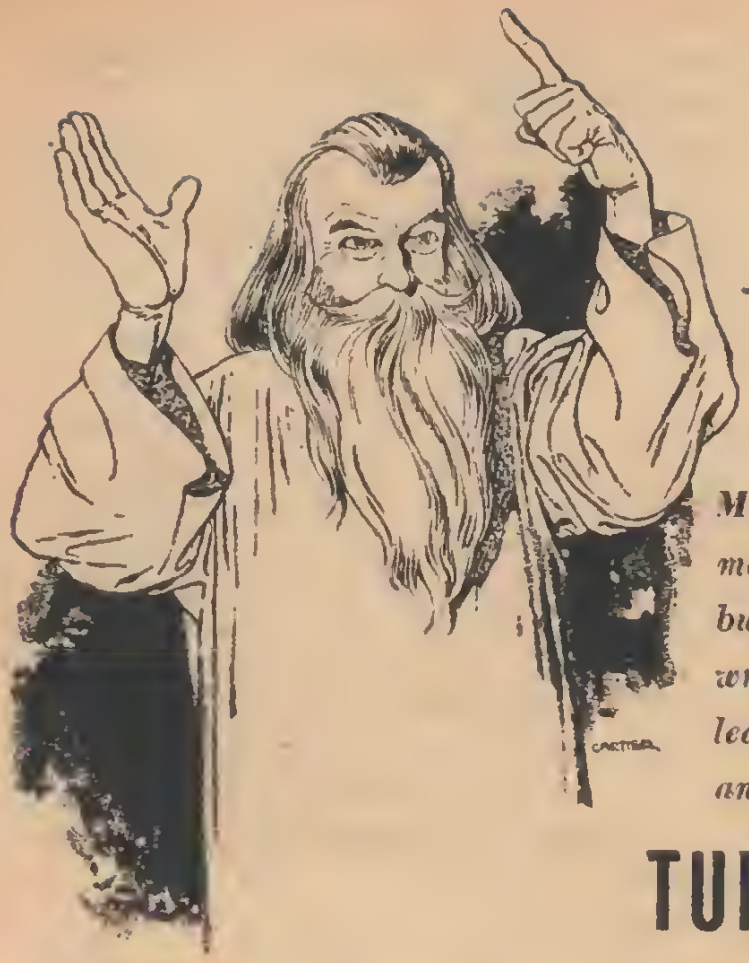
"You were right. We should never have created science. It brought the twilight of the race."

"I never said that. The race brought its own destruction, through misuse of science. Our culture was scientific anyway, in all except its psychological basis. It's up to us to take that last and hardest step. If we do, the race may yet survive."

Drummond gave Robinson a push toward the inner door. "You're exhausted, beat up, ready to quit. Go on in and see Elaine. Give her my regards. Then take a long rest before going back to work. I still think you've got a good kid."

Mechanically, the *de facto* President of the United States left the room. Hugh Drummond stared after him a moment, then went out into the street.

THE END.



Man, being an intelligent animal, learns by experience, but sometimes he draws the wrong conclusions. Like learning bitterly that science and passion don't mix—

TURNING POINT

BY PENDLETON BANKS

Illustrated by Cartier.

Bill Morgan left the trail and stumbled into a thicket. He crouched there, muscles taut, and looked back the way he had come.

The roar of the mob sounded faintly among the night noises. He could see the torches moving like sparks around Joseph Steinmeyer's house. As he watched, the single flame soaring up from the roof was joined by others and grew into a mass of fire, lighting up the shacks and derricks of Carrsville.

It was hard to believe that somewhere in that fire lay the body of Joseph Steinmeyer and all of his machines and equipment. Bill swore. The fear that had come with the first rock hurled by the mob vanished. Now he was angry; exhausted, too, and worried.

The trail was in plain sight all the way to where it disappeared into the mud walls of Carrsville. There was no one on it. The mob hadn't bothered to follow him. The frenzy which drove them to stone a man to death and burn his house wasn't enough to sustain a tiresome hunt through the forest for another victim.

Bill scrambled out of the thicket and started up the trail away from

Carrsville. It was easy going, even on a moonless night, because it followed the old railroad. The rails were gone and the ties crumbled to dust, while constant traffic on foot and horseback had kept it clear of brush.

Bill tried to picture the railroad as it must have looked before the Atom. Old Man Westfall had described it often—shining steel rails curving cleanly away, the great thundering locomotives, the cars strung behind. He tried hard to imagine this — he had seen pictures—but it was like all the wonderful things of the past. Gone before he was born, surviving now only in the minds of a few old men. Steinmeyer had been one of these—and Steinmeyer was dead.

The guard opened the gate, grumbling and yawning. Blinded by the guard's lantern Bill stumbled along the rubbish-filled street and fitted his wooden key into the big lock on Mr. Westfall's door. He opened and shut the door carefully and tiptoed across the room, but Westfall heard him and sat up in bed.

"What—" the old man said.

"It's me," said Bill.

"Why are you back so soon? Where is the wire?"

Bill sat down wearily. "The wire is a lump of copper in the ashes of Steinmeyer's house."

"I don't understand. Did Joseph have an accident?"

"It was no accident. The Prophet sent a mob of tribesmen to burn the house. Steinmeyer is dead."

"Joseph . . . dead?" The old man blinked.

"The mob came up, screaming something about the Atom and witches. Steinmeyer went to the door and tried to talk to them. They . . . stoned him. I dragged him inside. He was dead. Then they burned the house."

Westfall got out of bed and lit an oil lamp. Carrying it he went in the kitchen and came back with a plate of corn bread and fried meat.

"Here is your supper," he said.

Bill motioned it away.

"Eat it, son. This is a terrible thing but we have a job to do. We must go on living." He patted Bill's shoulder. "I'm glad you came back."

Bill tasted the food and discovered he was hungry. While he ate Westfall sat on the bed and stared at the floor.

"Joseph was a good friend and a good man," he said. "He believed in civilization and worked hard to bring it back. His death is a great loss."

"It is worse than that. What happened in Carrsville can happen here."

The old man shook his head. "I don't believe that, Bill. Not while Durett is boss of Oil City."

"He's supposed to be boss of Carrsville, too," Bill said. "Don't you see—this man who calls himself the Prophet is powerful. He talks to the people and feeds them whisky until they are ready to do anything he says."

"I'm afraid you are exaggerating, my boy. Durett will never let the Prophet come to Oil City."

Bill opened his mouth to speak but one look at Westfall told him it was no use. The old man had made up

his mind and no argument could change it.

"Call me when you get up," he said. "I'm going to get a little sleep."

Westfall didn't go back to bed. Blowing out the lamp he sat in the dark and thought of the past. The past had become an obsession with him, the distant past, the one he had known as a child and a student. The other one he tried to forget, the one that dated from the holocaust now remembered as the Atom. It was hard to ignore.

And yet he had seen little of what happened. With the breakdown of transportation and communication his world had shrunk until it included only Oil City and the nearby towns. He had watched Bill's great grandfather, another Bill Morgan, bring order out of chaos. He had helped build the first crude refinery and salvage the parts to keep a handful of trucks running.

Then there had been some hope of restoring at least a tiny segment of civilization. That hope faded when Morley Downs shot Morgan and took over the town. Rebuilding machinery, growing food, drilling new wells—all that called for hard work. It was easier—and more popular—to take the guns that were left and the powder Westfall could make, and raid the other towns for food and clothing. Downs died in one of the raids and Bill Morgan's son became Boss, but it was too late to go back to the rebuilding. The oil towns were embroiled in an endless series of wars. First among themselves, then against the tribes, migrating hordes who brought disease and hungry mouths.

Under Bill Morgan's grandson peace was in sight, the tribes turned back and the other towns destroyed or subdued. Then had begun the bloodiest battle of all, the battle to decide who should rule the tiny, starving kingdom that Oil City had become. That battle lasted one terrible night. When the sun rose over the smoking ruins of the town, the Boss and his family and friends lay dead. All except his son and Westfall, who had rescued the boy. The rebels spared Westfall for his knowledge and the boy because to kill him they would have had to kill Westfall.

Since that night Westfall and the last Bill Morgan had had ten years of peace in which to work. Ten years, and that hadn't been enough. A hundred might not suffice for the rebuilding of the shattered wreck of one town.

The sun was rising as Westfall stirred the fire and put the acorn coffee on to boil. He decided to let Bill sleep. There was work to do but it could wait.

In his mind he checked over the projects that were his responsibility. The oil wells—one gusher, two being stripped by gasoline pumps, one being drilled. The machine shop, also gasoline-powered, busy making parts for the pumps. The water pump and filter plant. The powder mill and armory, closed at present. And the newest, most valuable of them all—the electric plant.

He poured a cup of coffee and went to the drawing board. Here

were the plans. Sketches of the big gasoline-powered dynamo. A diagram of the distribution system. There would be no lights or electric stoves but power for a dozen other things. A sawmill. A power loom. A community refrigerator. A new machine shop. A paper mill, perhaps, and a printing press, later on. An electric furnace.

Westfall was dreaming of these things when he heard a knock at the door. He unlocked the door and opened it a crack. A youth with a rifle slung on his shoulder stood there.

"The Boss wants to see ya," he said.

"Very well," said Westfall.

The guard didn't move.

"What do you want?" asked Westfall.

"The Boss said you was to come with me."

Westfall went with him, silently raging. In the past the Boss had come to *him* or had sent a horse for him, at least.

They walked up the washed out gully which served as Oil City's main street. Children playing in the dirt among the pigs and chickens stopped to stare at Westfall's gray hair and cleanshaven face—he was one of the few who clung to the old custom of shaving. As they passed the pump house the guard winked at the women who were washing clothes and got a few smiles in reply.

They passed the warehouse where the town's food was stored and came to the Lodge. Here the young men lived until they married, serving as the Boss' guards. And here, in an office partitioned from the big bunk room, Westfall found the Boss.

Jason Durett was paunchy and red-faced. This was natural since he was the best fed man in Oil City. He motioned for Westfall to sit down.

"How is your electric plant coming along?" he asked.

Westfall started to tell him. "The generator is finished but we need more wire—"

"You are spending most of your time on this project, aren't you?"

"Yes."

Durett leaned over his desk. "I want you to stop. Today."

Westfall opened his mouth. Durett raised his hand and went on.

"I want you to reopen the powder mill and armory. I need a hundred new guns and powder and shot for five thousand rounds."

Westfall sat in stunned silence.

"You have heard of this man who calls himself the Prophet," Durett said. "Two days ago he brought his tribe to Carrsville. Last night a mob burned Steinmeyer's house. I don't want that to happen here."

Westfall stood up.

"You can't do this, Durett. If we stop building and go back to fighting, civilization is doomed. The machines will wear out."

"Do you think I'm a fool? I like your civilization, I want to see it restored. But my first and biggest job is to keep on being Boss." He looked at Westfall shrewdly. "And you want me to keep on being Boss. If the Prophet took over, you wouldn't have a chance. He doesn't

believe in machines. He tells the people that if the scientists go on working there will be another Atom."

Westfall started pacing up and down. Durett was right, unfortunately. Still, there must be some way—

He faced Durett. "I'll do what you say. I'll need a dozen men to help me."

"They will be at the mill when you get there," said Durett, smiling now. "I'm glad you see it my way."

Westfall found Bill drinking coffee and told him what had happened.

"I agreed to do what he said. I mean the part about the guns and powder," he said, smiling.

"You mean you aren't going to give up the electric plant?"

"That's right. While I work at the powder mill you are going to work here. Finish winding the motor armatures with the wire we have. When you give out you can go to Carrsville and see what you can salvage at Steinmeyer's house."

He started to leave, paused at the door.

"I told you Durett wouldn't let the Prophet come here, didn't I?"

Bill hid his grin until Westfall had gone out. The old man couldn't resist saying "I told you so."

Durett sat in his office and worried. Ten years had passed since he had done any fighting. The main problem during that time had been to find food for his people and to raise enough sheep and cotton for their clothes. But this was a different kind of problem. He would need more horses and more fodder. He must order target practice for the young men. He should send a patrol to watch the Prophet's tribe until he was ready to fight.

He got up and went to the window. He always got a thrill from looking through the only glass window in town. He looked down the main street and over the mud walls at the fields spread out beyond. There could be no fighting until the crops were in, he decided. It might be a long battle and to take all men from the town at harvest time would be inviting starvation. He remembered the lean winters of his youth and shook his head. Food came first, even if—

Durett stiffened, looked again. A crowd was gathering on the street and standing in its midst was a man in a white robe.

He roared for a guard. A youth appeared at the door. Durett motioned him to the window.

"Do you see that man down there?" Bring him up here."

The guard returned, escorting a middle-aged man with a neat red beard and a long white robe. Durett told the guard to wait outside and turned to the stranger.

"Are you the Prophet?"

"My name is Isaiah Stancil," replied the other. "My followers have rewarded my efforts with that title, I believe."

"What were you doing down in the street?" roared Durett.

"I was doing the Lord's work," Stancil said calmly. "Also I was hoping you would send for me."

His answer baffled Durett, who

stalled for time by walking around his desk and sitting down.

"You know that I could call the guard and have you shot, don't you?"

Stancil smiled. "I am not afraid. I have the shield of faith—and this." He drew a pistol from beneath his robe.

Durett was too startled to move. He watched Stancil put the gun back, pull up a chair and sit down.

"To tell the truth, Mr. Durett, I came here for this reason: I am tired of being a prophet. I want to be a priest."

The words obviously didn't make sense to Durett.

"I am spiritual leader of a dozen tribes," Stancil went on. "But I would rather be an ordinary citizen of a town. My people have nothing. They wander from town to town,

grateful for the garbage that is flung to them. I want you to let them camp between here and Carrsville and take you for their Boss. I will live here and preach to your people."

Durett found his voice. "Why should I do anything for you?"

"Because I speak with the voice of truth. Because people believe what I say. I could make it so your authority will never be questioned. Ever hear of the divine right of kings?"

Durett shook his head. Stancil explained the idea to him and the worried look began to leave Durett's face.

"All that sounds good," said Durett, "but it doesn't cover the subject. What's this about your people being afraid of scientists and machinery?"

Stancil drew back and a light came into his eyes. "You speak of the accursed. The men who call themselves scientists are witches and warlocks. They do the work of the devil. They wish to find the secret of the Atom again and destroy the world."

The light died and he stood up. "I am going back to my people now. Think of what I have said and send a messenger in two days to tell me your decision."

Stancil went out, closing the door quietly behind him. Durett started to call the guard, hesitated, decided against it. He got up and began pacing up and down. Odd that the Prophet had made no threats. A dozen tribes—that meant at least a thousand fighting men. And they would have weapons, science or no science. Durett frowned. That was threat enough.

The man was obviously crazy. Still he had some good ideas. This divine right business. If he didn't try to become Boss himself, if he stayed happy as spiritual leader and his people grew their own food—

A long time Durett walked up and down his office. He ate dinner at the head of the long table of young warriors and went back to his thoughts. Finally at sundown he called the guard.

"Send for Old Man Westfall. Tell him to come here at once."

Westfall found Bill in the workshop, winding a coil on the treadle-and-wheel jig. Bill looked up.

"What did he want this time?"

Westfall didn't answer for a moment, then he said, "It's bad news. I'm afraid Durett has made a deal with the Prophet."

"What do you mean?"

"He said that times were changing, that he didn't need me any more. He said that it would be best for you and me to leave town since he couldn't promise to protect us any longer."

Bill jumped up. "Why, that double crossing—"

Westfall held up his hand. "Words won't help us, son."

"What are you going to do about it, then?" Bill demanded.

"What am I going to do about it?" Westfall repeated. "There's nothing I can do. I can't fight the Prophet and I can't do what Durett

said and leave all this." He looked around him at the workshop. "This is my life's work, Bill."

Bill didn't answer. There was no answer possible. The old man went into the other room and came back with an armful of books and papers.

"What are you doing?" Bill asked.

"These are the things you will take with you when you go."

Bill saw in a flash what he meant. "No," he said. "I'm not going."

Westfall put his load down and went back for more, as if Bill hadn't spoken. "You can steal a horse tonight," he said over his shoulder. "I'll pack these books, some tools and food in two bags."

Bill stood silently and watched the old man. When he had gone into the other room again Bill went to a drawer and took out his pistol. It was a double-barreled muzzle loader he had made himself. Taking the bag of shot and can of powder he slipped out the back door before Westfall came back.

Bill Morgan lay on a hillside near Carrsville and watched the tribesmen gather in the hollow below. They brought torches and thrust them in the ground. Soon the clearing swarmed with people except for a space at one end. Here the Prophet would stand to speak to his people.

Bill studied the ground before him. If he walked boldly into the group and sat down, he might get away with it. But someone might recognize him as the man who escaped from Steinmeyer's house. The best way would be to circle through the woods to the place where the Prophet would stand.

As he watched the scene the Prophet appeared and began speaking. It was too far to hear what he said. Bill waited until the audience began to react with shouts and stamping feet. When the sounds were loud enough to drown any noise he might make, he started off through the woods.

There was no trail and no moon. The only way he could guide himself was by listening to the tribesmen. Keeping them on his right he made his way through the underbrush straight ahead. Ten minutes later he stopped, listened again and turned right. Soon he could see the flickering torchlight through the trees. Drawing his gun he crawled forward. In a moment the Prophet would be visible, silhouetted against the light, a perfect target—

Bill felt a hand on his shoulder. He twisted and tried to roll away, bringing his gun up at the same time. Two men fell on top of him. Aiming blindly he pulled both triggers and then used the gun as a club. It was no use. The men pinned him to the ground, tore the gun from his hand and began to beat him up. They worked quietly and systematically with fists and feet until Bill stopped moving and made no sound. Then they left him.

When Bill came to, the sun was hot on his face. He moved his head and pain stabbed his neck and shoulders. He lay back and waited until there was only a dull ache and tried again. This time, in spite of the

pain, he held his head up long enough to see that he was alone. The clearing was empty.

Relieved, he tried moving the rest of his body. A terrible moment of agony followed and he lay still, sweating and tense. Gradually he relaxed and giving up the idea of moving, he lay not thinking or feeling anything for a long time.

A fly buzzed past his face and the sound pulled him out of his daze. He moved his left arm. It hurt but moved anyway. His right arm moved but sent pain shooting through his chest. He tested his legs. They worked but he couldn't ignore the sharp pain in his belly.

After another long rest he propped himself up on one elbow and looked around the clearing. It was still empty but if the tribesmen came back and found him— He looked for cover. The ground sloped away from the clearing. There should be a creek at the bottom of the hill—a creek meant water to drink and a thicket dense enough to hide him.

Eternity separated his decision to crawl to the creek and his arrival there. A dozen times he was forced to stop and lie motionless until the pain subsided. The sun had set before he dragged his body the last torturing inch to the edge of the stream. He drank and washed the sweat off his face and drank again. Then exhausted and aching he fell asleep.

It was dark when he woke. He drank more water and realized he was hungry. Then he remembered his gun. There was no sound from the direction of the clearing so he decided to crawl back and hunt for it. He drew up his legs. The pain in his belly had become a throbbing soreness. Maybe— Excitedly he took hold of a sapling and pulled himself to his feet. His knees tried to fold up and his head swam but he shut his eyes and held on to the tree.

He tried walking and discovered that if he kept his right arm in his shirt and stopped every ten feet to rest, he could stay on his feet. The discovery invigorated him, gave him energy to keep looking for his pistol; after he was sure it was gone.

He straightened up slowly. Nothing to do now but go home. He didn't know what day it was—maybe home wasn't there any more. Grimly he forced himself to climb the hill and find the trail, not stopping every time his body cried out for rest. He set a limping, irregular pace and stuck to it except for brief halts to get his wind and quiet his screaming nerves. It was a beautiful night, warm and starry, but all he saw was the trail in front of him and all he heard was his own labored breathing.

He felt the blanket on top of him and opened his eyes. Looking at the familiar handmade furniture he struggled to remember how he got there. The attempt tired him and he went to sleep without succeeding.

The next time he woke Westfall was seated beside the bed. Bill tried to speak. The old man put a hand on his arm.

"Don't try to talk, Bill. I think I

know what hapened. When I found the gun was missing—"

"I guess I've spoiled your plans," Bill said.

"Nonsense, son. When you get well— The bags are all packed and ready to go."

"The Prophet—has he moved in yet?"

"The tribesmen began pitching their tents this morning," Westfall said. "I hear that Durett is giving them tools to clear the land just beyond his fields."

Bill shut his eyes. There was so little time—

All night and all the next day Bill could hear the moaning and shouting in the distance. At first he thought it was a nightmare recalling his experience at the clearing. But wide awake he heard the sounds too. They meant another meeting of the tribesmen, another wild harangue by the Prophet. Bill felt sick.

"Why don't you go, Mr. Westfall?" he asked as darkness fell the second night. "Don't you know they are coming here soon?"

The old man didn't answer.

"At least go up to the armory and get a rifle," Bill begged. "I can still shoot."

Westfall came and sat by the bed.

"I have been thinking about what is happening," he said. "I have made a discovery. I have discovered that progress depends on the people. It isn't something that can be imposed on them from above, as I have tried to do for many years. The people must passionately desire to live better, to build and improve, before progress can come to them." He paused and in the interval Bill heard the shouts grow louder. "It would do no good for you or me to escape now or try to fight. There is no place in the world where the people are ready to start the climb back to civilization. They are on the downswing now, on their way to the Dark Ages. They will live then as their fathers lived and put their trust in men like Durett and the Prophet. Their questions, if they have any, will be answered by superstition and they will be content."

He had to raise his voice, for the tribesmen were coming closer. "But a time will come when the world reaches the bottom of its cycle—a time when men will begin to ask questions they must answer themselves, when men will experiment and tinker and invent. Then will come a new Renaissance, a rebirth of knowledge and science and the arts." His eyes shone. "Ah, that would be the time to live, Bill, when every idea is a new one, every hypothesis untested, every machine a marvelous invention."

The cries of the mob came to them clearly now. "Death to the witches! Remember the Atom!" Bill sat up and took Westfall's hand as if to shake it. They sat motionless, staring at the dark, waiting. The first stone crashed into the room and from somewhere came the crackle of burning wood.

THE END.

LESS LIGHT, PLEASE

BY J. J. COUPLING

***Television** couldn't get out of its diaper days until a pickup device capable of satisfactory operation under ordinary lighting was available. Now the lid is lifted. A new image tube puts even candle-lit scenes within the reach of the television camera—and audience.*

One likes to think of an inventor having the bright idea Monday, making it work Tuesday, filing for a patent Wednesday and spending the rest of the week in peddling it for a million. Some inventions may go that way—a new kind of wrench, or garter, or paper clip. These are simple, complete things which, if one is lucky, can presumably be made to work immediately, smoothly fitting into a world with nuts to be tightened, socks to be held up and legs to hold them, and papers to be fastened. A lot of inventions are very different. The inventor has a really bright idea—for something to fit something that isn't there. Having invented one gadget, he immediately has to invent another gadget to make it work, and this new gimmick in turn requires another invention. An inventor with the true do-or-die spirit can drive himself frantic in this flight from one difficulty to another. An inventor with discretion may patent his idea, or merely publish it, and hope that the rest will come along in his lifetime.

Television is the will-o-the-wisp invention in all its glory. The first big step was taken by Nipkow, a Russian, in 1884. Inventors have been working on it ever since, and still most of us don't have television sets in our home. That's partly economics, though, and partly war. Although there are certainly plenty more inventions to be made in the field of television, it has finally got to the point of living on achievements, not prospects. There's no more of, "it would

Television views an historic scene at Hunter College, New York. Deliberations of UNO proceed under the "eye" of the image orthicon.

be all right if I only had a—." That thing they really needed badly to make television versatile enough to bring you what you will want to see has arrived. It is called the image orthicon.

Back before the war television had got to the point of transmitting pictures of a reasonably satisfactory quality under favorable conditions. This was the result of a long struggle, as we shall see. The worst feature of prewar television was at the transmitting end. The engineers and inventors had got to the point of picking up scenes with full daylight all right. They could also send scenes from studios with just a little less artificial illumination than that required to make the actors melt and run, or in any event, run. This hard-won performance was achieved with a pickup device called the iconoscope. The iconoscope is a true wonder in itself, but compared with the human eye it is pretty bad. With the iconoscope television couldn't have brought us the many unstaged events we would like to see. We could not have

had outdoor scenes on dark days, or indoor events under ordinary lighting conditions. Television with the iconoscope was a thing of bright days and bright lights. The image orthicon can see in bright moonlight, or by the beams of a single candle. The image orthicon, in short, can see about what the eye sees, and send it to your home.

A television camera which will see by candlelight is pretty impressive all in itself. The real achievement which it represents, however, can be appreciated only when one knows something of the difficulties which had to be overcome—of the many successive and important advances which were not quite good enough, and required something more to carry them a stage further. So, to see what made the image orthicon hard, we should go clear back to Nipkow, who contributed something which made television possible, and also made it very hard.

In sending a picture by television we couldn't expect perfect results—the reproduction of the finest hair of the head or the tiniest germ in a glass of water. Even the eye doesn't do that well. All one can reasonably hope is to send everything broader than a reasonably narrow line, or everything bigger than a reasonably small dot. What does this "reasonably small" mean? After much study, it has been decided that "reasonably small" is about 1/525 the height of the picture—hence, 525 line television. As the picture is chosen to be about a third broader than it is high, this means that a reasonably small dot has an area a little more than a four hundred thousandth as great as the whole picture.

We can, then, divide our picture into about four hundred thousand little areas. Then, if we manage to find out how bright each of these little areas is, and send the information for some distance, and use it to control the brightness of four hundred thousand other little areas, we have television. It's as simple as that.

In facing the problems of television, it's very important how we divide the picture into little areas and how we send the information as to how bright each little area is. We might examine the human eye. In it, the lens produces an image on the retina. The retina is composed of tiny light-sensitive devices. Each evaluates the light falling on it and sends a message to the brain along its own special nerve fiber. Thus, at each instant the brain receives simultaneously messages telling the brightness of all the tiny areas of the retina. Were we to build a television device on this scheme we would need four hundred thousand separate light-sensitive devices and four hundred thousand pairs of wires connecting the transmitter to the receiver. As if this weren't enough, if we wanted to send the signal any distance we would need four hundred thousand amplifiers, one for each pair of wires. We might note further that unless all of our four hundred thousand light-sensitive devices were

equally sensitive and unless all four hundred thousand amplifiers had just the same amplification, the reproduced picture would certainly be spotty and unsatisfactory.

What Nipkow did to make television easy was to conceive the idea of sending information as to the brightness of different little areas successively instead of all at once, as in the eye, and to invent a means for doing this. The first workable television used Nipkow's scheme exactly. Just one light-sensitive device was used, a photoelectric cell which gave an electric current of strength proportional to the amount of light falling on it. An image of the scene or picture to be transmitted was produced with a lens. Then, between the image and the photoelectric cell there was placed a Nipkow disk. This had a spiral pattern of tiny holes in it, each just as big as the smallest area to be transmitted. First the outermost hole swept across the image, letting pass to the photocell successively the light from each small area lying on the arc it swept across. Thus, the photocell produced and sent to the receiver an electric current specifying the brightness of all little areas lying along one narrow strip or "line" of the picture. Then, a hole a little nearer the center of the disk swept across the picture, sending information as to the brightness of the little areas along another line of the picture, adjacent to the first. In turn, all the lines of the picture were scanned and all the little areas covered. If the picture was completely scanned and reproduced fast enough—thirty times a second is standard—the eye, sluggishly unable to follow the motions of the scanning spot, saw the picture as if it were there all at once, instead of only one dot at a time. But, only one dot at a time was sent, not four hundred thousand, and to go with the one photoelectric cell there was needed only one pair of wires—or radio—and one amplifier. Each dot, picked up by the same phototube, sent through the same amplifier and reproduced at the far end by the same means was bound to arrive with the right intensity. Thus, Nipkow's method got rid both of the excessive complexity of sending all parts of the picture at once and the extreme difficulty—should that be done—of treating all parts alike and having them come out with the right brightnesses. This is what Nipkow did to make television easy.

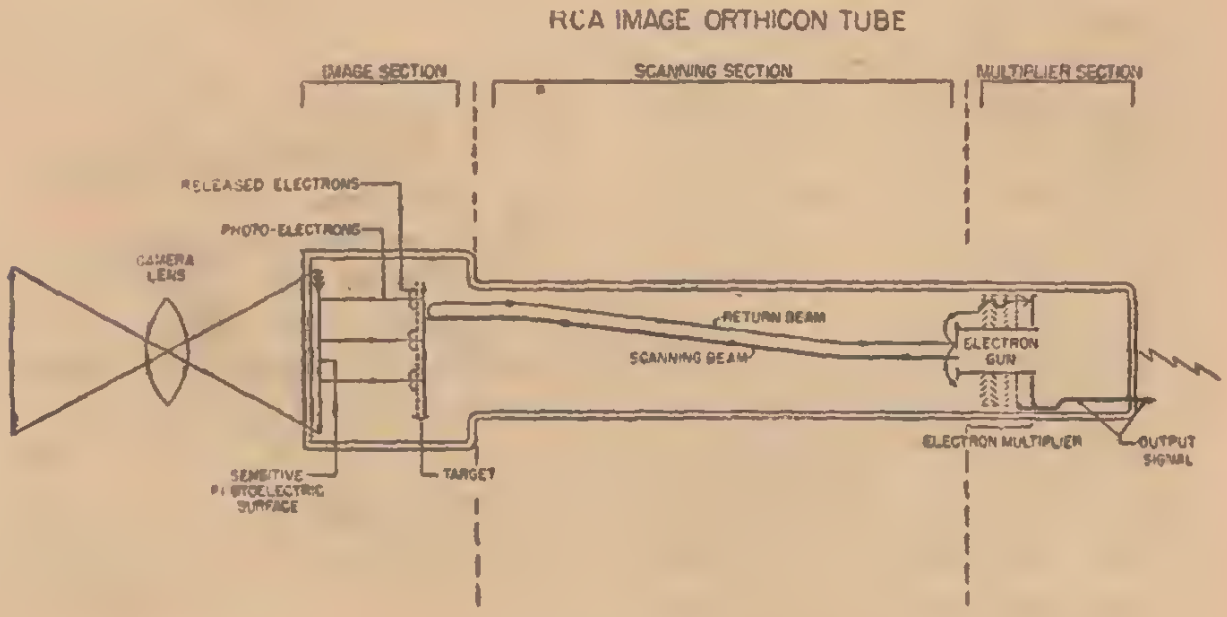
How did Nipkow make television hard? That's easy, if you think a minute. Suppose we sent all four hundred thousand areas of the picture simultaneously thirty times a second. Then, we would have a thirtieth of a second to find out how bright each area of the picture was. For one thing, the process would be leisurely. For another, the light falling on even a four hundred thousandth of a picture in a thirtieth of a second represents a reasonable, if small, amount of energy. But, sending the information about the four hundred thousand areas successively thirty times a second means that we have only a twelve millionth of a second to look at each area. For one thing,

we have to work fast. For another thing, not much light falls on a four hundred thousandth of a picture in a twelve millionth of a second.–

Let's look into this matter, and see just how bad things are. As a first shock to the uniniated, we might consider the lens which produces an image of the scene to be transmitted. Of course, to get lots of light we need a lens with a small f number—the f number is the focal length of the lens divided by its diameter. An f 2 lens is a good wide lens, and should let in lots of light. Suppose we focus our f 2 lens on a sheet of paper so white that all the light is reflected; then suppose that one unit of light strikes and is reflected from the paper per unit area—how much light passes through the image of the paper per unit area? Look at the curve in which this is plotted vs. the f number of the lens. For an f 2 lens only .057 as much light passes through each square inch of the image as leaves each square inch of the white paper. We've taken an eighteen to one beating at the start. This, while it is a pretty small loss compared to the four hundred thousand to one loss through looking at only a four

hundred thousandth of the picture at one time, means, nonetheless, that we need eighteen times as strong a light as if the image were as bright as the object, and that can make a lot of difference.

How are we to get an idea of the amount of light in one four hundred thousandth of the image, the light that falls on the photocell of the television transmitter we have been talking about? We can evaluate it in terms of the electric current it produces. Suppose, for example, we let the light of a hundred watt bulb fall on a perfectly white wall five feet away and, assuming an f 2 lens, an image about two inches square, and a reasonably sensitive photocell, calculate the electric current produced by the light passing through the one hole of the Nipkow disk which is between the image and the photocell at any one time. This overestimates the current, since actual objects will be much darker. We find that the current produced is one five millionth of a microampere, and a microampere is a millionth of an ampere. We need lots of gain to make this big enough to do anything!



Left: Within the sixteen inch length of the image orthicon some of the most striking phenomena known are put to work to convert an optical image into a small electric current which varies in accordance with the light intensity of the various parts of the scene.

Above: The sequence of operations is easily followed in the diagram, but developing the vacuum tube which performs them was an exacting problem, and manufacturing presents its own difficulties.

What about amplification? Even if we make the best amplifier possible, we are still faced with the fact that the very electrons which move in the wires and carry the currents are bounding around just as do the molecules in a hot gas. This produces a noise known as Johnson noise or thermal noise—because the velocities of the electrons and hence the amount of noise are increased with temperature. For a good amplifier of the sort that can amplify the rapid fluctuations of our television signal, one that will send the information about twelve million picture elements a second, this Johnson noise is equivalent to an input current of about a five hundredth of a microampere. But, our signal current is only a ten thousandth as big! Either we'll need not a hundred watt light but a million watt light, or we'll have to change our system. Actually, to make the signal current a hundred times as strong as the noise current and get a good signal we'd need a hundred million watt light.

Apparently, the combination of lens, Nipkow disk, photocell and amplifier just won't do to transmit 525-line television pictures. We must change something. In the long years before the invention of the image orthicon some pretty heroic measures were taken. One of these was the flying spot, demonstrated by the Bell Telephone Laboratories in 1927. The idea is, the photocell receives light from only a very small part of the scene at once. Suppose we illuminate only that part of the scene. Instead of a floodlight lighting, say, the face of a person, we will have a very fine spot of light which sweeps over the face, covering only a four hundred thousandth at once. Now we don't need a lens or a Nipkow disk. The lens and disk were used in obtaining light from just one part of the scene at one time. If we shine light on only one little area of the scene at one time, we can put our photocell out in the open, and we can use several photocells so as to pick up a lot of light. We'll gain a factor of at least four hundred thousand this way in the total amount of light needed, and probably more. Counting the gain as a million we'd thus need only a 1 watt light for the signal to be as great as the noise and with the 100 watt light the signal would be a hundred times as great as the noise. This sounds more reasonable.

Of course the flying spot wasn't any solution to the television problem. It made it possible to demonstrate the transmission of an image of the human face. You can't scan a large scene with a flying spot, though, and especially not an outdoor scene, which is already illuminated. The flying spot was an ingenious idea, but it wasn't the answer.

The really big break in the television pickup problem came when what are termed electronic pickup devices were devised. One of the first and most ingenious of these is the Farnsworth image dissector, which came along in 1934.

Here the image dissector is a lot

different from a Nipkow disk plus a photocell, although it serves the same purpose as this combination. I have included a cross-section diagram showing the essential parts of an image dissector tube, and a photograph showing an actual tube. The lens outside of the tube, to the right, produces a light image on the surface of the photocathode. This causes the emission of electrons from the photocathode. Lots of electrons leave where lots of light falls, and few electrons leave in the darker spots. The electrons leaving the photocathode are accelerated to the right by a voltage applied between the photocathode and an internal conducting ring at the other end of the tube. Current in a coil of wire or solenoid wound around the tube produces an axial magnetic field, and this focuses the electron flow from the photocathode so that near the right hand end of the tube an electron image is produced. This corresponds to the light image on the photocathode in every detail: high electron current, bright light, low electron current, dim light.

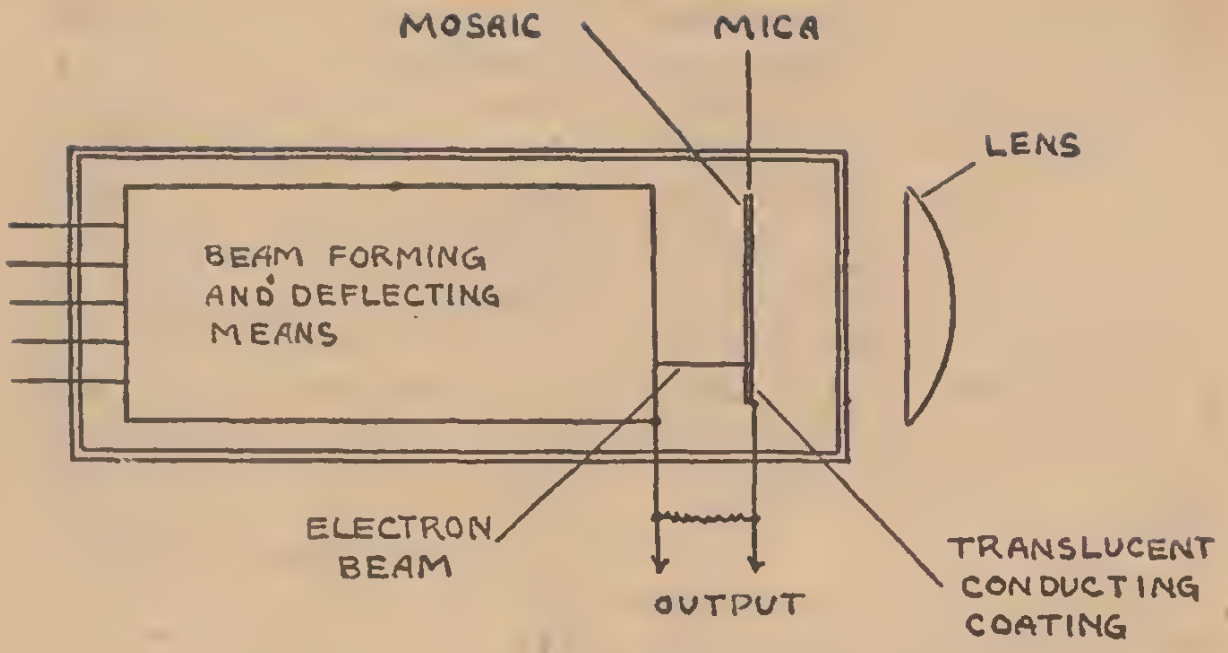
The image has now been converted into electron current, but it hasn't been scanned yet. We might think of scanning it by moving a tiny aperture over it, letting the electrons forming various small areas of the image pass through the aperture. That isn't the scheme, though. Instead, a fixed aperture is used and the whole electron image is made to move by means of magnetic fields produced by coils outside of the tube. One set of coils moves the image rapidly in its crosswise direction, scanning a line, and then returns it even more rapidly. Another set of coils moves the image from top to bottom in 1/30 of a second so that the various lines are scanned.

As the image moves past the fixed scanning aperture, electrons from all small areas of it successively pass through the aperture. They don't go directly to the input of the amplifier, however. If they did, the image dissector would be no more sensitive than the combination of photocell and Nipkow disk. Instead, the electrons passing through the scanning aperture form the input of an electron multiplier, which is housed in a little metal box so that the only way electrons can get into it is through the scanning aperture. The electron multiplier is an ingenious device in which electrons strike a *secondary emitting* surface and knock out more electrons. These in turn are accelerated toward another secondary emitting surface and knock out still more. The process may be repeated until the initial current is multiplied a million times or more. If you want to know more about electron multipliers, you might read "Activity" in the November 1946 issue of *Astounding Science Fiction.*

Now, instead of the few electrons passing through the scanning aperture we have perhaps a million times as many reaching the output electrode of the multiplier and going to the input of the amplifier. Thus, instead of the five five millionth of a microampere we calculated, we will have an output current of a

fifth of a microampere. Our noise current was only a five hundredth of a microampere. Everything is fine! The hundred watt lamp five feet away is enough to transmit a picture a hundred times as strong as the noise. Or is it?

The current passing through the aperture into the electron multiplier is still only a five millionth of a microampere. We have to scan over all four hundred thousand elementary areas of the picture in a thirtieth of a second, so for each area the current flows into the multiplier for only a twelve millionth of a second. Now, current is just the rate of flow of charge. If we express the current as—one five millionth of a millionth of an ampere—and divide it by twelve million we get the total charge entering the multiplier for each picture element. It is one divided by six followed by nineteen zeros. This is almost exactly a tenth of the charge of an electron!



SHOWING THE PRINCIPLES OF THE

RCA ORTHICON

Left: The orthicon, precursor of the image orthicon, was simpler inside, but far less sensitive. It was usable only for scenes with very brilliant illumination. Even ham actors resent being roasted.

Above: In the business end of the orthicon the light image focused on the mosaic by the lens produces corresponding changes in the scanning electron beam. Low sensitivity limits the tube's usefulness.

What does this mean? It means that for even the brightest part of the picture we would have only a chance in ten of getting an electron through the aperture of the multiplier in scanning one elementary area. To send a good picture we would need many electrons through the aperture in scanning a bright area, so that, say, one electron through the aperture would indicate a very dark area, ten a medium area and a hundred a bright area. To get a hundred electrons per scan from each small bright area, however, we would need not a hundred watt light five feet away, but a hundred thousand watt light five feet away. While this is about a thousand times as good as we did with the Nipkow disk and photocell combination which didn't have an electron multiplier, it still isn't good enough.

The image dissector is still used sometimes in sending motion picture

film. In that case the light can be put right behind the film, not five feet away, and not nearly so much wattage is needed. The image dissector is free from certain faults of other more sensitive devices to be described later, and so in this instance has an advantage which makes up for its lack of sensitivity. But, it certainly won't see by moonlight, and, indeed, not by any light tolerable to actors or just plain human beings.

Obviously, it took some entirely new principle to make "live pickup" possible. The first device embodying this principle is the iconoscope, first announced by Zworykin in 1923 and brought to a good working state at RCA by 1934, the year the image dissector came out. As you can see from the picture, the iconoscope looks quite different from the image dissector. The workings are quite different, too, as you can see from the cross-section drawing.

The heart of the iconoscope is the mosaic, on which a lens outside of the tube throws a light image. The mosaic is built up on a thin sheet of mica. On the front of the mosaic, the side toward the lens, are very many tiny particles of silver, each insulated from all the rest. These particles are treated to make each one a good photoelectric emitter. Thus, light falling on any little silver particle of the mosaic will cause photoelectrons to leave it. We can imagine these photoelectrons going to the conducting coating which covers a large part of the inside of the iconoscope bulb, which is a little positive with respect to the mosaic and attracts the electrons.

Suppose, then, we start out with the mosaic a little negative with respect to the conducting coating, and with all the particles charged to the same potential. As the light of the image thrown on the mosaic by the lens causes electrons to leave the particles, each will acquire a small positive charge as it loses electrons. The particles where the image is brightest will lose most electrons and will become most positive; those in the darker regions will become less positive. Thus, the light image will be reproduced as an image in terms of electric potential; high voltage at bright and low voltage at dark. Of course, all these voltage differences between light and dark are small fractions of a volt.

The iconoscope contains an electron gun, set off in a side tube at an angle so as not to get in the way of the light from the lens. There are also two sets of deflecting plates, so that the fine electron beam from the gun can be made to scan over the surface of the mosaic, sweeping over all little areas of the image each thirtieth of a second. When the fast electrons of the beam from the gun strike the mosaic, they knock out lots of secondary electrons; this tends to charge the mosaic positively until the secondaries have no place more positive to go; after this they fall back as fast as they leave. However, the electron beam in scanning the mosaic raises all parts of the mosaic to the same potential. Thus, a little area which is bright and therefore more positive than the rest

suffers less change in potential than a little area which is dark and therefore initially less positive than the rest. Now, as the potential of each little area is changed by scanning, current flows in a lead connected to a metal plate covering the back of the mosaic, for each little particle of the mosaic is coupled to the backing plate by a small condenser formed by the particle, the mica, and the backing plate. This current flows through a resistance to the metal lining of the tube, and the drop across the resistance is the signal output of the iconoscope.

Perhaps you have noticed an inconsistency in the above explanation. I started out by assuming that the mosaic was negative with respect to the conducting coating inside of the tube, so that the photoelectrons leaving the mosaic would be drawn off to the coating. Then I said that after scanning the mosaic would be left positive with respect to the coating. The latter is certainly so. Then, can't the photoelectrons leave the mosaic? Is the iconoscope inoperative?

It doesn't pay to be too logical. Although a patent office examiner would probably rule the iconoscope to be inoperative if he were given the explanation above and no evidence of reduction to practice, the iconoscope nevertheless does work. The mosaic is positive with respect to the conducting coating just after scanning. How do the photoelectrons produced by the image leave it? Presumably, some of them leave with more than average speed, and these get away while the others are turned back. This means that not as many would leave as if they had a positive electrode to go to, but enough do leave to give a signal.

It's a good strong signal, too. Why is this? The virtue of the iconoscope is that electrons leave each little area of the mosaic not just when the electron beam is hitting it, but for the whole thirtieth of a second between the time the electron beam leaves the area and the time it hits the area again. All during this time electrons are leaving the area and a charge is accumulating on it which will ultimately form the signal output from that area—when the area is scanned. Thus, the electron current which contributes to the signal would be four hundred thousand times that for the Nipkow disk and the photocell, or that entering the aperture of the image dissector—if all the photoelectric emission could leave the mosaic.

With the iconoscope we don't have the advantage of the electron multiplier, so performance is limited by noise in the amplifier to which the tube is connected, as in the case of the Nipkow disk and photocell pickup. We remember that with that arrangement, a hundred million watts at five feet would be needed to make the highlight signal a hundred times as strong as the noise. If the iconoscope achieved the full "storage" advantage of four hundred thousand, we'd need only 250 watts at five feet to get a good signal. Actually, considerably more light than this is needed with the iconoscope, and it gives

good live pickup—with good, bright floodlights which aren't too easy on the actors but are bearable.

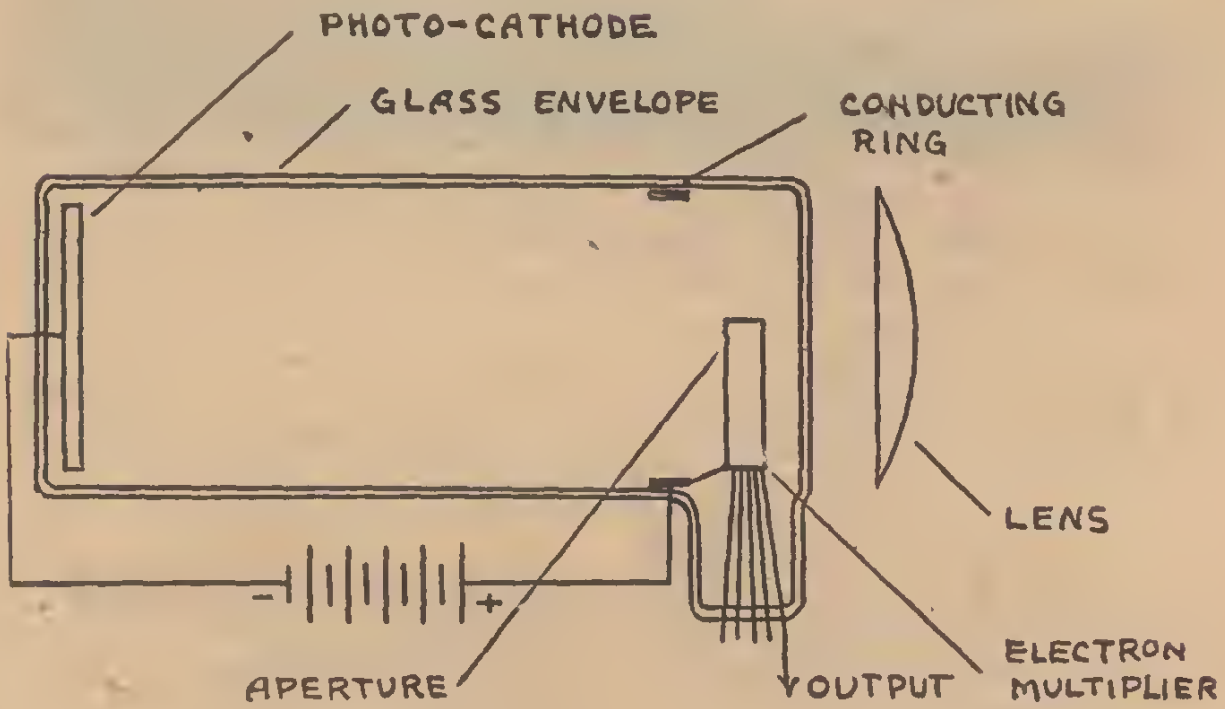
The fact that scanning the mosaic with the electron beam leaves it positive so that electrons have difficulty in leaving it does more than reduce the sensitivity of the iconoscope, however. Electrons leaving one part of the mosaic tend to go to nearby parts which are more positive, confusing the picture. Moreover, the secondaries which leave the mosaic while it is being scanned tend to land on various other parts of the mosaic, giving rise to mottled light and dark areas. The confused behavior of the iconoscope changes with time. Certain areas of the picture get first too light and then too dark. Fortunately, the changes tend to be gradual and can be partially corrected by *shading* circuits which add to the output a controllable signal similar to that which would be produced by a light or dark splotch on the image. By adjusting the shading signal it is possible to make the reproduced image lighter or darker at the top or bottom, to the left or the right, or at the center or the edges. Thus the changing un-

evenness of brightness of the iconoscope signal can be compensated for.

If I've given the impression that the iconoscope is a nasty, unsatisfactory piece of equipment, it's no lie. But the iconoscope *was* a big improvement, and *did* make reasonably acceptable live pickup possible. That's achievement enough.

A lot of effort has gone into overcoming the defects of the iconoscope. Attempts have been made to add electron multipliers to it—a tricky job. These, however, lie rather out of the main line of progress which led to the image orthicon. The next really big step after the iconoscope was the orthicon, a queer looking tube indeed as you will see from the photograph.

The orthicon is pretty complicated inside. In fact, it is so complicated in some respects that it wouldn't be much fun to explain it in detail, either to author or to reader. Fortunately the real complications are called for in doing something that can in itself be easily stated, so we'll leave out the gadgeteering and tell what it does. All the really nasty



FARNSWORTH IMAGE DISSECTOR

Left: The iconoscope was an earlier and fairly successful device for converting the optical image into an amplifiable electric current.

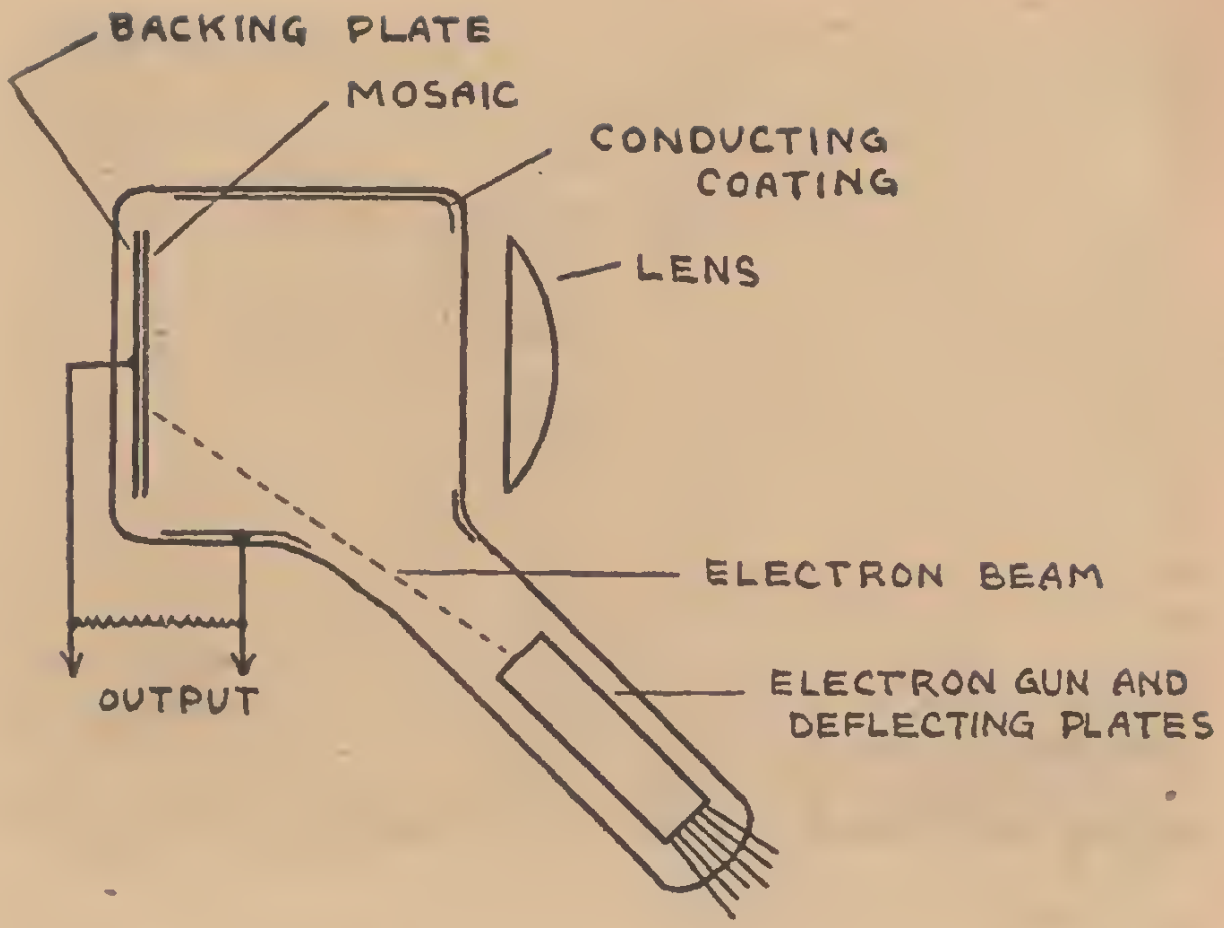
Above: In the iconoscope the electron gun which emits the scanning beam is on the same side of the photoelectric mosaic as the image.

Above: The Farnsworth image dissector arrived on the television scene the year RCA's iconoscope reached workable efficiency.

Right: Too insensitive for direct pickup under tolerable lighting, the image dissector is still used occasionally for film transmission.

parts are in the part of the highly schematic picture labeled "beam forming and deflecting means" which will remain a closed box to the reader.

The rest of the orthicon is simple and easy to understand. A lens focuses an image on a mosaic which is somewhat similar to the mosaic of the iconoscope. In this case, however, the conducting "backing plate" is very thin and transparent, and the light forming the image passes right through it to get to the photosensitive silver particles, which are on the side of the mica away from the lens. Just as in the iconoscope, the light causes electrons to leave the little particles of the mosaic, so that they charge up positively, most positively where most light falls on the mosaic and least positively where least light falls on the mosaic. Only this time the electrons really can leave the mosaic, all of them, for the "beam forming and deflecting means" really is considerably positive with respect to the mosaic at all



RCA ICONOSCOPE

times, so that it whisks away all of the electrons emitted from the mosaic, however low their speeds.

How is it that in the orthicon we can obtain this field away from the mosaic, while in the iconoscope we couldn't? It's a big difference in the speed of the electron beam which scans the mosaic and removes the signal that does it. In the iconoscope the beam hit the mosaic at a high speed, so that each electron striking the mosaic knocked several out. The spot on which the beam fell got more and more positive as the secondary electrons left, until it was so positive that the secondaries were pulled right back. In the orthicon, on the contrary, the electron beam which scans the mosaic is made up of slow-speed electrons, going much too slowly to knock electrons out of the mosaic when they hit it. Instead, when the electrons of the beam scanning the orthicon hit the mosaic, they stick. Thus, electrons accumulate on the point the beam is striking until it

gets so *negative* that it repels any more electrons heading for it. After that, any more electrons heading for that point are simply turned back.

Thus, after the electron beam has swept over a little area on the mosaic, that little area is left at a very definite negative potential, determined by the speed or energy of the electrons of the scanning beam. Then, between the time the beam leaves the little area and the time it returns on the next scan, the little area emits electrons at a rate proportional to the brightness of the image at that point and hence acquires a positive charge proportional to the brightness. When the beam falls on the little area again and brings it back to the same negative potential as before, just as many beam electrons will strike the area and stick as the area emitted between scans. The beam electrons flowing to the little area constitute a current. This current is coupled to the output circuit, which is connected to the translucent conducting coating on the other side of the mica, by the capacity of the condenser formed by the little conducting particles of the mosaic and the conducting coating opposite them.

So far we haven't said anything about the hard part of the orthicon, the part in the mysterious box. The beam is shot toward the mosaic in a retarding electric field—the electrons of the beam slow up as they approach the mosaic, and, as we remember, as electrons reach the mosaic and stick the electrons of the beam finally slow right to a stop and turn around and go back without hitting the mosaic. Now, everything is all right as long as the electrons forming the beam are shot right straight at the mosaic. Then they go straight toward it, and straight back. When the mosaic becomes so negative that the electrons can't reach it, they still head right for the same spot until they stop. If the electrons approached the mosaic at an angle, however, they would travel in paths curved away from the mosaic because of the electric field pushing them away. As the mosaic charged up negatively and this field became stronger the electron paths would curve more and more, and the electrons wouldn't go to the same spot on the mosaic, but would wander off elsewhere. This wouldn't do at all, of course, for the scanning beam must trace out a definite pattern on the mosaic, and hit each point at just the right predetermined time.

It isn't easy to make an electron beam move over the surface of a mosaic, heading straight toward it all the time. The deflecting plates and deflecting coils needed to do this are here just lumped together as beam forming and deflecting means.

The orthicon overcame all of the very bad features of the iconoscope. It doesn't have changing dark and bright splotches which need to be compensated for. It has about the sensitivity an iconoscope would have if all instead of only some of the emitted photoelectrons could get away from the mosaic. About the

only objections are that the particles of the mosaic aren't quite as good photoemitters as the uniform surface of a photoelectric cell, and that the orthicon doesn't have the feature of the photomultiplier which helped the image dissector so.

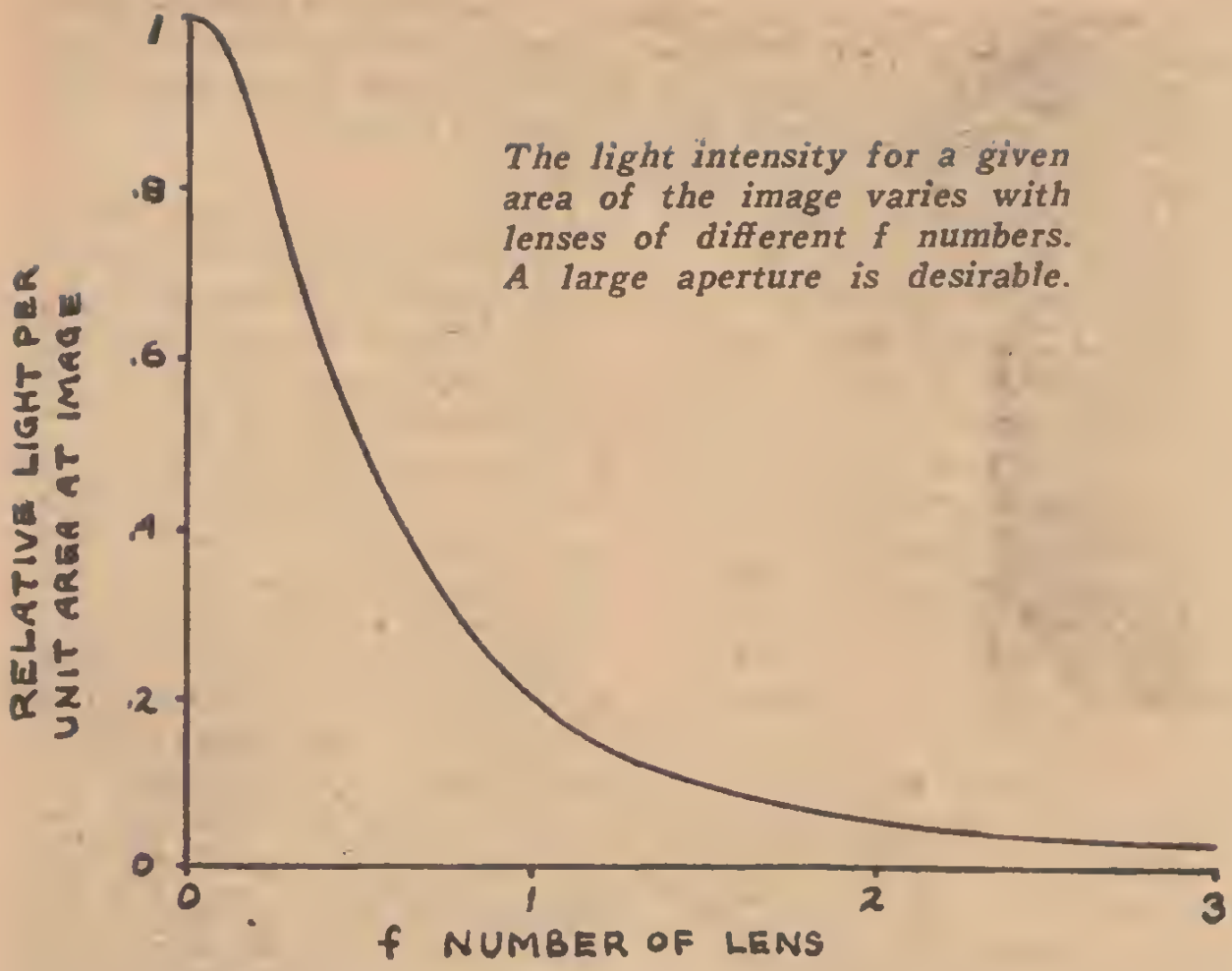
At last we've come to the image orthicon. Let's start at the lens end of the diagram. We have right on the inside of the glass end of the tube a semitransparent photosensitive surface on which the camera lens forms an image of the scene to be sent. This surface is considerably more photosensitive than the mosaic of the orthicon or iconoscope; that is, it emits more electrons per unit light.

The electrons which leave the photocathode are drawn by an electric field toward a very fine grid which is held positive with respect to the photocathode. During their motion toward this fine grid they are focused by a magnetic field, so that the electrons reaching the grid form an electron image of the light image on the photocathode—many electrons where the light image is bright and few electrons where the light image is dark. Most of the electrons which reach this fine grid pass right through the openings in it and strike a very thin sheet of glass right behind the grid. The electrons strike this thin sheet of glass hard enough to knock out secondary electrons. Thus, when electrons strike, more electrons leave; there is a net loss of electrons, and the glass becomes charged positively, not negatively. Further, we have a sort of electron multiplier, for one electron striking the glass can cause several electrons to leave, and thus can change that charge more than it would if it stuck.

So far, we have seen that the electrons from the photocathode tend to form a pattern of charge on the side of glass toward the lens, reproducing the light image falling on the photocathode. The rest of the diagram tells us that this charge is on the wrong side of the glass, however, for the electron beam which scans the glass strikes the other side. How come? Well, I said that the glass is thin, and I really meant it. It is only about a ten thousandth of an inch thick. That's about a twentieth as thick as a human hair. In fact, the glass is so thin, and the electrical capacity between the two sides is so high, that when the side toward the lens becomes positive through secondary electrons leaving it, the side toward the electron beam becomes almost as positive. And, if there is at any time much voltage difference between the two sides of the glass, it produces such a strong field that electrons can leak right through the thin film, good insulator that it is.

Thus, the positive charge on the lens side of the glass acts just as if it were on the electron-beam side as well. We merely have to scan the glass with a low-velocity beam as in the orthicon, and we have our television signal.

There's more to the image orthicon than that, however. In the orthicon we were content to take for



The light intensity for a given area of the image varies with lenses of different f numbers. A large aperture is desirable.

our signal the flow of electrons to the mosaic as the beam wiped out the positive charge. This is a very small current, and leads to trouble with amplifier noise. In the image orthicon, however, the electron-optics of the device are such that the electrons which are turned back from the mosaic go back to almost the point they came from. They finally strike a secondary-emitting electrode surrounding the small aperture from which they emerged. Secondary electrons bounce off into an electron multiplier, and the output of the multiplier forms a fine strong signal. When the scanning beam strikes a part of the glass corresponding to a highlight of the image, a very positive part of the glass, a lot of electrons are absorbed in neutralizing the positive charge and the beam coming back is weaker than normal: this means a weaker current out of the electron multiplier. Similarly, when the beam scans a part of the glass corresponding to a dark area, more electrons come out of the multiplier.

The image orthicon has, as we said, everything. It has all the advantages of the orthicon. It has a more sensitive photocathode. And, it has electron multiplication twice —once when the electrons from the photocathode strike the lens side of the glass, and once when the return beam, which carries the signal, goes

The image orthicon frees television from the straitjacket of low sensitivity. NBC cameras are shown in action at a Madison Square Garden sports event, transmitting the scene under the normal lights of the arena. Such operation was impossible with earlier devices.

into the electron multiplier and is amplified to provide the output signal. Just how sensitive does this make the image orthicon? Well, the image dissector had the sensitive photocathode and the electron multiplier. In it, however, we used only the electrons which left a given area of the photocathode during the time of scanning one elementary area of the picture, and this is only a four hundred thousandth of the total scanning period. In the image orthicon we accumulate or store the electrons for each little area for the whole time between scans, and then use them, so to speak, at the moment of scanning. Thus, for each little area we have four hundred thousand times as many electrons to deal with as in the case of the image dissector, so the image orthicon should require only a four hundred thousandth as much as the image dissector—we have neglected the small gain in the image orthicon due to secondary emission at the lens side of the glass sheet. Now, it was calculated earlier that with the image dissector we needed a hundred thousand watt light five feet away to transmit a good picture. Then, with the image orthicon we should need only a quarter watt light! Actually, the image orthicon will transmit a picture—if not too good a one—by the light of a single candle—one watt on our scale—so our estimate, even if it didn't take everything into account—and there's a lot I haven't mentioned—came out pretty well.

Anything beyond this would have to be a letdown. We've come from devices which required enough light to roast anything but a motion picture film to a tube which will transmit by the pale light of the moon. Does this mean that the problems of television are solved? Well, that's another story. For instance, how about a picture as big and bright as that on a real movie screen? Or, to start a real fight, how about color?

THE END.

SLAN
BY A. E. VAN VOGT

"Slan" has been brought out in book form at last—if you missed it in the magazine, here's your chance. If you're missing those back copies and want to read it again—ditto. At your book dealer's, or from Arkham House Publishers, Sauk City, Wisconsin. It's $2.50 per copy.

BY
ISAAC ASIMOV

Illustrated by Orban.

LITTLE LOST ROBOT

"Lost", as referring to a robot, is a little hard to explain. The robot knew where he was, all right—but nobody else did, and they absolutely had to find him—

Measures on Hyper Base had been taken in a sort of rattling fury —the muscular equivalent of an hysterical shriek.

To itemize them in order of both chronology and desperation, they were:

1. All work on the Hyperatomic Drive through all the space volume occupied by the Stations of the Twenty-Seventh Asteroidal Grouping came to a halt.

2. That entire volume of space was nipped out of the System, practically speaking. No one entered without permission. No one left under any conditions.

3. By special government patrol ship, Drs. Susan Calvin and Peter Bogert, respectively Head Psychologist and Mathematical Director of United States Robot & Mechanical Men Corporation, were brought to Hyper Base.

Susan Calvin had never left the surface of Earth before, and had had no perceptible desire to leave it this time. In an age of Atomic Power and a clearly coming Hyperatomic Drive, she remained quietly provincial. So she was dissatisfied with her trip and unconvinced of the emergency, and every line of her plain, middle-aged face showed it clearly enough during her first dinner at Hyper Base.

Nor did Dr. Bogert's sleek paleness abandon a certain hangdog attitude. Nor did Major general Kallner, who headed the project,

even once forget to maintain a haunted expression.

In short, it was a grisly episode, that meal, and the little session of three that followed began in a gray, unhappy manner.

Kallner, with his baldness glistening, and his dress uniform oddly unsuited to the general mood, began with uneasy directness.

"This is a queer story to tell, sir, and madam. I want to thank you for coming on short notice and without a reason being given. We'll try to correct that now. We've lost a robot. Work has stopped and *must* stop until such time as we locate it. So far we have failed, and we feel we need expert help."

Perhaps the general felt his predicament anticlimactic. He continued with a note of desperation, "I needn't tell you the importance of our work here. Since the first imperfect Hyper Drive was constructed, the government has spared no effort here. More than eighty percent of last year's appropriations for scientific research have gone to us—"

"Why, we know that," said Bogert, agreeably. "U.S. Robots is receiving a generous rental fee for use of our computing robot."

Susan Calvin injected a blunt, vinegary note, "What makes a single robot so important to the project, and why hasn't it been located?"

The general turned his red face towards her and wet his lips quickly, "Why, in a manner of speaking we *have* located it." Then, with near anguish, "Here, suppose I explain. As soon as the robot failed to report, a state of emergency was declared, and all movement off Hyper Base stopped. A cargo vessel had landed the previous day and had delivered us two robots for our laboratories. It had sixty two robots of the . . . uh . . . same type for shipment elsewhere. We are certain as to that figure. There is no question about it whatever."

"Yes? And the connection?"

"When our missing robot failed of location anywhere—I assure you we would have found a missing blade of grass if it had been there to find—we brainstormed ourselves into counting the robots left on the cargo ship. They have sixty-three now."

"So that the sixty-third, I take it, is the missing prodigal?" Dr. Calvin's eyes darkened.

"Yes, but we have no way of telling which is the sixty-third."

There was a dead silence while the electric clock chimed eleven times, and then the robopsychologist said, "Very peculiar," and the corners of her lips moved downwards.

"Peter," she turned to her colleague with a trace of savagery, "what's wrong here? What kind of robots are they using at Hyper Base?"

Dr. Bogert hesitated and smiled feebly, "It's been rather a matter of delicacy till now, Susan."

She spoke rapidly, "Yes, *till* now. If there are sixty-three same-type robots, one of which is wanted and the identity of which cannot be

determined, why won't any of them do? What's the idea of all this? Why have we been sent?"

Bogert said in resigned fashion, "If you'll give me a chance, Susan— Hyper Base happens to be using several robots whose brains aren't impressioned with the entire First Law of Robotics."

"*Aren't* impressioned?" Calvin slumped back in her chair, "I see. How many were made?"

"A few. It was on government order and there was no way of violating the secrecy. No one was to know except the top men directly concerned. You weren't included, Susan. It was nothing I had anything to do with."

The general interrupted with a measure of authority. "I would like to explain that bit. I hadn't been aware that Dr. Calvin was unacquainted with the situation. I needn't tell you, Dr. Calvin, that there always has been strong opposition to robots on the Planet. The only defense the government has had against the Fundamentalist radicals in this matter was the fact that robots are always built with an unbreakable First Law—which makes it impossible for them to harm human beings under any circumstances.

"But we *had* to have robots of a different nature. So just a few of the NS-2 model, the Nestors, that is, were prepared with a modified First Law. To keep it quiet, all NS-2's are manufactured without serial numbers; modified members are delivered here along with a group of normal robots; and, of course, all our kind are under the strictest impressionment never to tell of their modification to unauthorized personnel." He wore an embarrassed smile, "This has all worked out against us now."

Calvin said grimly, "Have you asked each one who it is, anyhow? Certainly, you are authorized?"

The general nodded, "All sixty-three deny having worked here—and one is lying."

"Does the one you want show traces of wear? The others, I take it, are factory-fresh."

"The one in question only arrived last month. It, and the two that have just arrived, were to be the last we needed. There's no perceptible wear." He shook his head slowly and his eyes were haunted again, "Dr. Calvin, we don't dare let that ship leave. If the existence of non-First Law robots becomes g e n e r a l knowledge—" There seemed no way of avoiding understatement in the conclusion.

"Destroy all sixty-three," said the robopsychologist coldly and flatly, "and make an end of it."

Bogert drew back a corner of his mouth. "You mean destroy thirty thousand dollars per robot. I'm afraid U. S. Robots wouldn't like that. We'd better make an effort first, Susan, before we destroy anything."

"In that case," she said, sharply, "I need facts. Exactly what advantage does Hyper Base derive from these modified robots? What factor made them desirable, general?"

Kallner ruffled his forehead and

smoothed it with an upward gesture of his hand, "We had trouble with our previous robots. Our men work with hard radiations a good deal, you see. It's dangerous, of course, but reasonable precautions are taken. There have been only two accidents since we began and neither was fatal. However, it was impossible to explain that to an ordinary robot. The First Law states—I'll quote it—*'No robot may harm a human being, or through inaction, allow a human being to come to harm.'*

"That's primary, Dr. Calvin. When it was necessary for one of our men to expose himself for a short period to a moderate gamma field, one that would have no physiological effects, the nearest robot would dash in to drag him out. If the field were exceedingly weak, it would succeed, and work could not continue till all robots were cleared out. If the field were a trifle stronger, the robot would never reach the technician concerned, since its positronic brain would collapse under gamma radiations—and then we would be out one expensive and hard-to-replace robot.

"We tried arguing with them. Their point was that a human being in a gamma field was endangering his life and that it didn't matter that he could remain there half an hour safely. Supposing, they would say, he forgot and remained an hour. They couldn't take chances. We pointed out that they were risking their lives on a wild off-chance. But self-preservation is only the Third Law of Robotics—and the First Law of human safety came first. We gave them orders; we ordered them strictly and harshly to remain out of gamma fields at whatever cost. But obedience is only the Second Law of Robotics—and the First Law of human safety came first. Dr. Calvin, we either had to do without robots, or do something about the First Law—and we made our choice."

"I can't believe," said Dr. Calvin, "that it was found possible to remove the First Law."

"It wasn't removed, it was modified," explained Kallner. "Positronic brains were constructed that contained the positive aspect only of the Law, which in them reads: *'No robot may harm a human being.'* That is all. They have no compulsion to prevent one coming to harm through an extraneous agency such as gamma rays. I state the matter correctly, Dr. Bogert?"

"Quite," assented the mathematician.

"And that is the only difference of your robots from the ordinary NS-2 model? The *only* difference? Peter?"

"The *only* difference, Susan."

She rose and spoke with finality. "I intend sleeping now, and in about eight hours, I want to speak to whoever saw the robot last. And from now on, General Kallner, if I'm to take any responsibility at all for events, I want full and unquestioned control of this investigation."

Susan Calvin, except for two hours of resentful lassitude, experienced nothing approaching sleep. She signaled at Bogert's door at the local time of 0700 and found him also awake. He had apparently taken the trouble of transporting a dressing gown to Hyper Base with him, for he was sitting in it. He put his nail scissors down when Calvin entered.

He said, softly, "I've been expecting you more or less. I suppose you feel sick about all this."

"I do."

"Well—I'm sorry. There was no way of preventing it. When the call came out from Hyper Base for us, I knew that something must have gone wrong with the modified Nestors. But what was there to do? I couldn't break the matter to you on the trip here as I would have liked to, because I had to be sure. The matter of the modification is top secret."

The psychologist muttered, "I should have been told. U. S. Robots had no right to modify positronic brains this way without the approval of a psychologist."

Bogert lifted his eyebrows and sighed, "Be reasonable, Susan. You couldn't have influenced them. In this matter, the government was bound to have its way. They want the Hyperatomic Drive and the etheric physicists want robots that won't interfere with them. They were going to get them even if it did mean twisting the First Law. We had to admit it was possible from a construction standpoint and they swore a mighty oath that they wanted only twelve, that they would be used only at Hyper Base, that they would be destroyed once the Drive were perfected, and that full precautions would be taken. And they insisted on secrecy—and that's the situation."

Dr. Calvin spoke through her teeth, "I would have resigned."

"It wouldn't have helped. The government was offering the company a fortune, and threatening it with antirobot legislation in case of a refusal. We were stuck then, and we're badly stuck now. If this leaks out, it might hurt Kallner and the government, but it would hurt U. S. Robots a devil of a lot more."

The psychologist stared at him, "Peter, don't you realize what all this is about? Can't you understand what the removal of the First Law means? It isn't just a matter of secrecy."

"I know what removal would mean. I'm not a child. It would mean complete instability, with no nonimaginary solutions to the positronic Field Equations."

"Yes, mathematically. But can you translate that into crude psychological thought. All normal life, Peter, consciously or otherwise, resents domination. If the domination is by an inferior, or by a supposed inferior, the resentment becomes stronger. Physically, and, to an extent, mentally, a robot—any robot—is superior to human beings. What makes him slavish, then? *Only the First Law!* Why, without it, the first order you tried to give a robot

would result in your death. Unstable? What do you think?"

"Susan," said Bogert, with an air of sympathetic amusement. "I'll admit that this Frankenstein Complex you're exhibiting has a certain justification—hence the First Law in the first place. But the Law, I repeat and repeat, has not been removed—merely modified."

"And what about the stability of the brain?"

The mathematician thrust out his lips, "Decreased, naturally. But it's within the border of safety. The first Nestors were delivered to Hyper Base nine months ago, and nothing whatever has gone wrong till now, and even this involves merely fear of discovery and not danger to humans."

"Very well, then. We'll see what comes of the morning conference."

Bogert saw her politely to the door and grimaced eloquently when she left. He saw no reason to change his perennial opinion of her as a sour and fidgety frustration.

Susan Calvin's train of thought did not include Bogert in the least. She had dismissed him years ago as a smooth and pretentious sleekness.

Gerald Black had taken his degree in etheric physics the year before and, in common with his entire generation of physicists, found himself engaged in the problem of the Drive. He now made a proper addition to the general atmosphere of these meetings on Hyper Base. In his stained white smock, he was half rebellious and wholly uncertain. His stocky strength seemed striving for release and his fingers, as they twisted each other with nervous yanks, might have forced an iron bar out of true.

Major general Kallner sat beside him, the two from U.S. Robots faced him.

Black said, "I'm told that I was the last to see Nestor 10 before he vanished. I take it you want to ask me about that."

Dr. Calvin regarded him with interest, "You sound as if you weren't sure, young man. Don't you *know* whether you were the last to see him?"

"He worked with me, ma'am, on the field generators, and he was with me the morning of his disappearance. I don't know if anyone saw him after about noon. No one admits having done so."

"Do you think anyone's lying about it?"

"I don't say that. But I don't say that I want the blame of it, either." His dark eyes smoldered.

"There's no question of blame. The robot acted as it did because of what it is. We're just trying to locate it, Mr. Black, and let's put everything else aside. Now if you've worked with the robot, you probably know it better than anyone else. Was there anything unusual about it that you noticed? Had you ever worked with robots before?"

"I've worked with other robots we have here—the simple ones. Nothing different about the Nestors except that they're a good deal cleverer—and more annoying."

"Annoying? In what way?"

"Well—perhaps it's not their fault. The work here is rough and most of us get a little jagged. Fooling around with hyper-space isn't fun." He smiled feebly, finding pleasure in confession. "We run the risk continually of blowing a hole in normal space-time fabric and dropping right out of the universe, asteroids and all. Sounds screwy, doesn't it? Naturally, you're on edge sometimes. But these Nestors aren't. They're curious, they're calm, they don't worry. It's enough to drive you nuts at times. When you want something done in a tearing hurry, they seem to take their time. Sometimes I'd rather do without."

"You say they take their time? Have they ever refused an order?"

"Oh, no,"—hastily. "They do it all right. They tell you when they think you're wrong, though. They don't know anything about the subject but what we taught them, but that doesn't stop them. Maybe I imagine it, but the other fellows have the same trouble with their Nestors."

General Kallner cleared his throat ominously, "Why have no complaints reached me on the matter, Black?"

The young physicist reddened, "We didn't *really* want to do without the robots, sir, and besides we weren't certain exactly how such .. uh , . . minor complaints might be received."

Bogert interrupted softly, "Anything in particular happen the morning you last saw it?"

There was a silence. With a quiet motion, Calvin repressed the comment that was about to emerge from Kallner, and waited patiently.

Then Black spoke in blurting anger, "I had a little trouble with it. I'd broken a Kimball tube that morning and was out five days of work; my entire program was behind schedule; I hadn't received any mail from home for a couple of weeks. And *he* came around wanting me to repeat an experiment I had abandoned a month ago. He was always annoying me on that subject and I was tired of it. I told him to go away—and that's all I saw of him."

"You told him to go away?" asked Dr. Calvin with sharp interest. "In just those words? Did you say 'Go away'? Try to remember the exact words."

There was apparently an internal struggle in progress. Black cradled his forehead in a broad palm for a moment, then tore it away and said defiantly, "I said, 'Go lose yourself.'"

Bogert laughed for a short moment, "And he did, eh?"

But Calvin wasn't finished. She spoke cajolingly, "Now we're getting somewhere, Mr. Black. But exact details are important. In understanding the robot's actions, a word, a gesture, an emphasis may be everything. You couldn't have said just those three words, for instance, could you? By your own description you must have been in a hasty mood. Perhaps you strengthened your speech a little."

The young man reddened. "Well

. . . I may have called it a . . . a few things."

"Exactly what things?"

"Oh—I wouldn't remember exactly. Besides I couldn't repeat it. You know how you get when you're excited. His embarrassed laugh was almost a giggle, "I sort of have a tendency to strong language."

"That's quite all right," she replied, with prim severity. "At the moment, I'm a psychologist. I would like to have you repeat exactly what you said as nearly as you remember, and, even more important, the exact tone of voice you used."

Black looked at his commanding officer for support, found none. His eyes grew round and appalled, "But I can't."

"You must."

"Suppose," said Bogert, with ill-hidden amusement, "you address me. You may find it easier."

The young man's scarlet face turned to Bogert. He swallowed. "I said—" His voice faded out. He tried again, "I said—"

And he drew a deep breath and spewed it out hastily in one long succession of syllables. Then, in the charged air that lingered, he concluded almost in tears, ". . . more or less. I don't remember the exact order of what I called him, and

maybe I left out something or put in something, but that was about it."

Only the slightest flush betrayed any feeling on the part of the robopsychologist. She said, "I am aware of the meaning of most of the terms used. The others, I suppose, are equally derogatory."

"I'm afraid so," agreed the tormented Black.

"And in among it, you told him to lose himself."

"I meant it only figuratively."

"I realize that. No disciplinary action is intended, I am sure." And at her glance, the general, who, five seconds earlier, had seemed not sure at all, nodded angrily.

"You may leave, Mr. Black. Thank you for your co-operation."

It took five hours for Susan Calvin to interview the sixty-three robots. It was five hours of multi-repetition; of replacement after replacement of identical robot; of Questions A, B, C, D and Answers A, B, C, D; of a carefully bland expression, a carefully neutral tone, a carefully friendly atmosphere; and a hidden wire recorder.

The psychologist felt drained of vitality when she was finished.

Bogert was waiting for her and looked expectant as she dropped the recording spool with a clang upon the plastic of the desk.

She shook her head, "All sixty-three seemed the same to me. I couldn't tell—"

He said, "You couldn't expect to tell by ear, Susan. Suppose we analyze the recordings."

Ordinarily, the mathematical interpretation of verbal reactions of robots is one of the more intricate branches of robotic analysis. It requires a staff of trained technicians and the help of complicated computing machines. Bogert knew that. Bogert stated as much, in an extreme of unshown annoyance after having listened to each set of replies, made lists of word deviations, and graphs of the intervals of responses.

"There are no anomalies present, Susan. The variations in wording and the time reactions are within the limits of ordinary frequency groupings. We need finer methods. They must have computers here. No." He frowned and nibbled delicately at a thumbnail. "We can't use computers. Too much danger of leakage. Or maybe if we—"

Dr. Calvin stopped him with an impatient gesture, "Please, Peter. This isn't one of your petty laboratory problems. If we can't determine the modified Nestor by some gross difference that we can see with the naked eye, one that there is no mistake about, we're out of luck. The danger of being wrong, and of letting him escape is otherwise too great. It's not enough to point out a minute irregularity in a graph. I tell you, if that's all I've got to go on, I'd destroy them all just to be certain. Have you spoken to the other modified Nestors?"

"Yes, I have," snapped back Bogert, "and there's nothing wrong with them. They're above normal in friendliness if anything. They answered my questions, displayed

pride in their knowledge—except the two new ones that haven't had time to learn their etheric physics. They laughed rather good-naturedly at my ignorance in some of the specializations here." He shrugged, "I suppose that forms some of the basis for resentment towards them on the part of the technicians here. The robots are perhaps too willing to impress you with their greater knowledge."

"Can you try a few Planar Reactions to see if there has been any change, any deterioration, in their mental set-up since manufacture."

"I haven't yet, but I will." He shook a slim finger at her, "You're losing your nerve, Susan. I don't see what it is you're dramatizing. They're essentially harmless."

"They are?" Calvin took fire. "They are? Do you realize one of them is lying. One of the sixty-three robots I have just interviewed has deliberately lied to me after the strictest injunction to tell the truth. The abnormality indicated is horribly deep-seated, and horribly frightening."

Peter Bogert felt his teeth harden against each other. He said, "Not at all. Look! Nestor 10 was given orders to lose himself. Those orders were expressed in maximum urgency by the person most authorized to command him. You can't counteract that order either by superior urgency or superior right of command. Naturally, the robot will attempt to defend the carrying out of his orders. In fact, objectively, I admire his ingenuity. How better can a robot lose himself than to hide himself among a group of similar robots?"

"Yes, you would admire it. I've detected amusement in you, Peter—amusement and an appalling lack of understanding. Are you a roboticist, Peter? Those robots attach importance to what they consider superiority. You've just said as much yourself. Subconsciously they feel humans to be inferior and the First Law which protects us from them is imperfect. They are unstable. And here we have a young man ordering a robot to leave him, to lose himself, with every verbal appearance of revulsion, disdain, and disgust. Granted, that robot must follow orders, but subconsciously, there is resentment. It will become more important than ever for it to prove that it is superior despite the horrible names it was called. It may become *so* important that what's left of the First Law won't be enough."

"How on Earth, or anywhere in the Solar System, Susan, is a robot going to know the meaning of the assorted strong language used upon him? Obscenity is not one of the things impressioned upon his brain."

"Original impressionment is not everything," Calvin snarled at him. "Robots have learning capacity, you . . . you fool—" And Bogert knew that she had really lost her temper. She continued hastily, "Don't you suppose he could tell from the tone used that the words weren't complimentary? Don't you suppose he's heard the words used before and noted upon what occasions."

"Well, then," shouted Bogert, "will you kindly tell me one way in which a modified robot can harm a human being, no matter how offended it is, no matter how sick with desire to prove superiority."

"If I tell you one way, will you keep quiet?"

"Yes."

They were leaning across the table at each other, angry eyes nailed together.

The psychologist said, "If a modified robot were to drop a heavy weight upon a human being, he would not be breaking the First Law, if he did so with the knowledge that his strength and reaction speed would be sufficient to snatch the weight away before it struck the man. However once the weight left his fingers, he would be no longer the active medium. Only the blind force of gravity would be that. The robot could then change his mind and merely by inaction, allow the weight to strike. The modified First Law allows that."

"That's an awful stretch of imagination."

"That's what my profession requires sometimes. Peter, let's not quarrel. Let's work. You know the exact nature of the stimulus that caused the robot to lose himself. You have the records of his original mental make-up. I want you to tell me how possible it is for our robot to do the sort of thing I just talked about. Not the specific instance, mind you, but that whole class of response. And I want it done quickly."

"And meanwhile—"

"And meanwhile, we'll have to try performance tests directly on the response to First Law."

Gerald Black, at his own request, was supervising the mushrooming wooden partitions that were springing up in a bellying circle on the vaulted third floor of Radiation Building 2. The laborers worked, in the main, silently, but more than one was openly a-wonder at the sixty-three photocells that required installation.

One of them sat down near Black, removed his hat, and wiped his forehead thoughtfully with a freckled forearm.

Black nodded at him, "How's it doing, Walensky?"

Walensky shrugged and fired a cigar, "Smooth as butter. What's going on anyway, Doc? First, there's no work for three days and then we have this mess of jiggers." He leaned backwards on his elbows and puffed smoke.

Black twitched his eyebrows, "A couple of robot men came over from Earth. Remember the trouble we had with robots running into the gamma fields, before we pounded it into their skulls that they weren't to do it."

"Yeah. Didn't we get new robots?"

"We got some replacements, but mostly it was a job of indoctrination. Anyway, the people who make them want to figure out robots that aren't hit so bad by gamma rays."

"Sure seems funny, though, to stop all the work on the Drive for

this robot deal. I thought nothing was allowed to stop the Drive."

"Well, it's the fellow upstairs that have the say on that. Me—I just do as I'm told. Probably all a matter of pull—"

"Yeah," the electrician jerked a smile, and winked a wise eye. "Somebody knew somebody in Washington. But as long as my pay comes through on the dot, I should worry. The Drive's none of my affair. What are they going to do here?"

"You're asking me? They brought a mess of robots with them,—over sixty, and they're going to measure reactions. That's all *my* knowledge."

"How long will it take?"

"I wish I knew."

"Well," Walensky said, with heavy sarcasm, "as long as they dish me my money, they can play games all they want."

Black felt quietly satisfied. Let the story spread. It was harmless, and near enough to the truth to take the fangs out of curiosity.

A man sat in the chair, motionless, silent. A weight dropped, crashed downward, then pounded aside at the last moment under the synchronized thump of a sudden force beam. In sixty-three wooden cells, watching NST-2 robots dashed forward in that split second before the weight veered, and sixty-three photocells five feet ahead of their original positions jiggled the marking pen and presented a little jag on paper. The weight rose and dropped, rose and dropped, rose—

Ten times!

Ten times the robots sprang forward and stopped, as the man remained safely seated.

Major-general Kallner had not worn his uniform in its fulness since the first dinner with the U. S. Robot representatives. He wore nothing over his blue-gray shirt now, the collar was open, and the black tie was pulled loose.

He looked hopefully at Bogert, who was still blandly neat and whose inner tension was perhaps betrayed only by the trace of glister at his temples.

The general said, "How does it look? What is it you're trying to see?"

Bogert replied, "A difference which may turn out to be a little too subtle for our purposes, I'm afraid. For sixty-two of those robots the necessity of jumping toward the apparently threatened human was what we call, in robotics, a forced reaction. You see, even when the robots knew that the human in question would not come to harm — and after the third or fourth time they must have known it—they could not prevent reacting as they did. First Law requires it."

"Well?"

"But the sixty-third robot, the modified Nestor, had no such compulsion. He was under free action. If he had wished, he could have remained in his seat. Unfortunately," and his voice was mildly regretful, "he didn't so wish."

"Why do you suppose?"

Bogert shrugged, "I suppose Dr. Calvin will tell us when she gets here. Probably with a horribly pes-

simistic interpretation, too. She is sometimes a bit annoying."

"She's qualified, isn't she?" demanded the general with a sudden frown of uneasiness.

"Yes." Bogert seemed amused. "She's qualified all right. She understands robots like a sister—comes from hating human beings so much, I think. It's just that, psychologist or not, she's an extreme neurotic. Has paranoid tendencies. Don't take her too seriously."

He spread the long row of broken-line graphs out in front of him. "You see, general, in the case of each robot the time interval from moment of drop to the completion of a five-foot movement tends to decrease as the tests are repeated. There's a definite mathematical relationship that governs such things and failure to conform would indicate marked abnormality in the positronic brain. Unfortunately, all here appear normal."

"But if our Nestor 10 was not responding with a forced action, why isn't his curve different? I don't understand that."

"It's simple enough. Robotic responses are not perfectly analogous to human responses, more's the pity. In human beings, voluntary action is much slower than reflex action. But that's not the case with robots; with them it is merely a question of freedom of choice, otherwise the speeds of free and forced action are much the same. What I *had* been expecting, though, was that Nestor 10 would be caught by surprise the first time and allow too great an interval to elapse before responding."

"And he didn't?"

"I'm afraid not."

"Then we haven't gotten anywhere." The general sat back with an expression of pain. "It's five days since you've come."

At this point, Susan Calvin entered and slammed the door behind her. "Put your graphs away, Peter," she cried, "you know they don't show anything."

She mumbled something impatiently as Kallner half-rose to greet her, and went on, "We'll have to try something else quickly. I don't like what's happening."

Bogert exchanged a resigned glance with the general. "Is anything wrong?"

"You mean specifically? No. But I don't like to have Nestor 10 continue to elude us. It's bad. It *must* be gratifying his swollen sense of superiority. I'm afraid that his motivation is no longer simply one of following orders. I think it's becoming more a matter of sheer neurotic necessity of outwitting humans. That's a dangerously unhealthy situation. Peter, have you done what I asked? Have you worked out the instability factors of the modified NS-2 along the lines I want?"

"It's in progress," said the mathematician, without interest.

She stared at him angrily for a moment, then turned to Kallner. "Nestor 10 is decidedly aware of what we're doing, general. He had no reason to jump for the bait in this experiment, especially after the first time, when he must have seen that there was no real danger to our subject. The others couldn't help it;

but *he* was deliberately falsifying a reaction."

"What do you think we ought to do now, then, Dr. Calvin?"

"Make it impossible for him to fake an action the next time. We will repeat the experiment, but with an addition. High-tension cables, capable of electrocuting the Nestor models will be placed between subject and robot—enough of them to avoid the possibility of jumping over—and the robot will be made perfectly aware in advance that touching the cables will mean death."

"Hold on," spat out Bogert with sudden viciousness. "I rule that out. We are not electrocuting two million dollars worth of robots to locate Nestor 10. There are other ways."

"You're certain? You've found none. In any case, it's not a question of electrocution. We can arrange a relay which will break the current at the instant of application of weight. If the robot should place his weight on it, he won't die. *But he won't know that,* you see."

The general's eyes gleamed into hope. "Will that work?"

"It should. Under those conditions, Nestor 10 would have to remain in his seat. He could be *ordered* to touch the cables and die, for the Second Law of obedience is superior to the Third Law of self-preservation. But he *won't* be ordered to; he will merely be left to his own devices, as will all the robots. In the case of the normal robots, the First Law of human safety will drive them to their death even without orders. But not our Nestor 10. Without the entire First Law, and without having received any orders on the matter, the Third Law, self-preservation, will be the highest operating, and he will have no choice but to remain in his seat. It would be a forced action."

"Will it be done tonight, then?"

"Tonight," said the psychologist, "if the cables can be laid in time. I'll tell the robots now what they're to be up against."

A man sat in the chair, motionless, silent. A weight dropped, crashed downward, then pounded aside at the last moment under the synchronized thump of a sudden force beam.

Only once—

And from her small camp chair in the observing booth in the balcony, Dr. Susan Calvin rose with a short gasp of pure horror.

Sixty-three robots sat quietly in their chairs, staring owlishly at the endangered man before them. Not one moved.

Dr. Calvin was angry, angry almost past endurance. Angry the worse for not daring to show it to the robots that, one by one, were entering the room and then leaving. She checked the list. Number Twenty-Eight was due in now—Thirty-five still lay ahead of her.

Number Twenty-eight entered, diffidently.

She forced herself into reasonable calm. "And who are you?"

The robot replied in a low, uncertain voice, "I have received no number of my own yet, ma'am. I'm an NS-2 robot, and I was Number Twenty-eight in line outside. I have

a slip of paper here that I'm to give you."

"You haven't been in here before this today?"

"No, ma'am."

"Sit down. Right there. I want to ask you some questions, Number Twenty-eight. Were you in the Radiation Room of Building Two about four hours ago?"

The robot had trouble answering. Then it came out hoarsely, like machinery needing oil, "Yes, ma'am."

"There was a man who almost came to harm there, wasn't there?"

"Yes, ma'am."

"You did nothing, did you?"

"No, ma'am."

"The man might have been hurt because of your inaction. Do you know that?"

"Yes, ma'am. I couldn't help it, ma'am." It is hard to picture a large, expressionless metallic figure cringing, but it managed.

"I want you to tell me exactly why you did nothing to save him."

"I want to explain, ma'am. I certainly don't want to have you . . . have *anyone* . . . think that I could do a thing that might cause harm to a master. Oh, no, that would be a horrible . . . an inconceivable—"

"Please don't get excited, boy. I'm not blaming you for anything. I only want to know what you were thinking at the time."

"Ma'am, before it all happened you told us that one of the masters would be in danger of harm from that weight that keeps falling and that we would have to cross electric cables if we were to try to save him. Well, ma'am, that wouldn't stop me. What is my destruction compared to the safety of a master? But . . . but it occurred to me that if I died on my way to him, I wouldn't be able to save him anyway. The weight would crush him and then I would be dead for no purpose and perhaps some day some other master might come to harm who wouldn't have, if I had only stayed alive. Do you understand me, ma'am?"

"You mean that it was merely a choice of the man dying, or both the man and yourself dying. Is that right?"

"Yes, ma'am. It was impossible to save the master. He might be considered dead. In that case, it is inconceivable that I destroy myself for nothing—without orders."

The robopsychologist twiddled a pencil. She had heard the same story with insignificant verbal variations twenty-seven times before. This was the crucial question now.

"Boy," she said, "your thinking has its points, but it is not the sort of thing I thought you might think. Did you think of this yourself?"

The robot hesitated. "No."

"Who thought of it, then?"

"We were talking last night, and one of us got that idea and it sounded reasonable.'

"Which one?"

The robot thought deeply. "I don't know. Just one of us."

She sighed, "That's all."

Number Twenty-nine was next. Thirty-four after that.

Major general Kallner, too, was angry. For one week all of Hyper Base had stopped dead, barring

some paper work on the subsidiary asteroids of the group. For nearly one week, the two top experts in the field had aggravated the situation with useless tests. And now they—or the woman, at any rate — made impossible propositions.

Fortunately for the general situation, Kallner felt it impolitic to display his anger openly.

Susan Calvin was insisting, "Why not, sir? It's obvious that the present situation is unfortunate. The only way we may reach results in the future—or what future is left us in this matter — is to separate the robots. We can't keep them together any longer."

"My dear Dr. Calvin," rumbled the general, his voice sinking into the lower baritone registers. "I don't see how I can quarter sixty-three robots separately on the Base without trouble. We'd have to take them out of the ship. We'd have to place guards over each one, since you haven't even narrowed down the possibilities — meaning no offense. So far we've managed to keep this predicament of ours secret enough. We've explained away our tests plausibly. But guarding sixty-three robots all over the place—"

Dr. Calvin raised her arms helplessly. "I can do nothing then. Nestor 10 will either imitate what the other robots would do, or else argue them plausibly into not doing what he himself cannot do. And in any case, this is bad business. We're in actual combat with this little lost robot of ours and he's winning out. Every victory of his aggravates his abnormality."

She rose to her feet in determination. "General Kallner, if you do not separate the robots as I ask, then I can only demand that all sixty-three be destroyed immediately."

"You demand it, do you?" Bogert looked up suddenly, and with real anger. "What gives you the right to demand any such thing. Those robots remain as they are. *I'm* responsible to the management, not you."

"And I," added Major General Kallner, "am responsible to the World Co-ordinator — and I must have this settled."

"In that case," flashed back Calvin, "there is nothing for me to do but resign. If necessary to force you to the necessary destruction, I'll make this whole matter public. It was not I that approved the manufacture of modified robots."

"One word from you, Dr. Calvin," said the general, deliberately, "in violation of security measures, and you would be certainly imprisoned instantly."

Bogert felt the matter to be getting out of hand. His voice grew syrupy, "Well, now, we're beginning to act like children, all of us. We only need a little more time. Surely we can outwit a robot without resigning, or imprisoning people, or destroying two millions."

The psychologist turned on him with quiet fury. "No hypocrisy from you, Peter Bogert. You're after Lanning's place as Director of Research. You have been for five years at least. And destroying thirty robots will spoil your chances. That doesn't ask any deep psychology, you

know, just a half-open eye. Well, I'm not ambitious. I just don't want any unbalanced robots in existence. We have one Nestor that's definitely unbalanced, eleven more that are potentially so, and sixty-two normal robots that are being subjected to an unbalanced environment. The only absolutely safe method is complete destruction."

The signal-burr brought all three to a halt, and the angry tumult of growingly unrestrained emotion froze.

"Come in," growled Kallner.

It was Gerald Black, looking perturbed. He had heard angry voices. He said, "I thought I'd come myself . . . didn't like to ask anyone else—"

"What is it? Don't orate—"

"The locks on Compartment C in the trading ship have been played with. There are fresh scratches on them."

"Compartment C," exclaimed Calvin quickly. "That's the one that holds the robots, isn't it?? Who did it?"

"From the inside," said Black, laconically.

"The lock isn't out of order, is it?"

"No. It's all right. I've been staying the ship now for four days and none of them have tried to get out. But I thought you ought to know, and I didn't like to spread the news. I noticed the matter myself."

"Is anyone there now?" demanded the general.

"I left Robbins and McAdams there."

There was a thoughtful silence, and then Dr. Calvin said, ironically, "Well?"

Kallner rubbed his nose uncertainly, "What's it all about?"

"Isn't it obvious? Nestor 10 is planning to leave. That order to lose himself is dominating his abnormal brain past anything we can do. I wouldn't be surprised if what's left of his First Law would scarcely be powerful enough to override it. He is perfectly capable of seizing the ship and leaving with it. Then we'd have a mad robot on a spaceship. What would he do next? Any idea? Do you still want to leave them all together, general?"

"Nonsense," interrupted Bogert. He had regained his smoothness. "All that from a few scratch marks on a lock."

"Have you, *Dr.* Bogert, completed the analysis I've required, since you volunteer opinions?"

"Yes."

"May I see it?"

"No."

"Why not? Or mayn't I ask that, either?"

"Because there's no point in it, Susan. I told you in advance that these modified robots are less stable than the normal variety, and my analysis shows it. There's a certain very small chance of breakdown under extreme circumstances that are not likely to occur. Let it go at that. I won't give you ammunition for your absurd claim that sixty-two perfectly good robots be destroyed just because so far you lack the ability to detect Nestor 10 among them."

Susan Calvin stared him down and let disgust fill her eyes. "You won't let anything stand in the way of the directorship, will you?"

"Please," begged Kallner, half in irritation. "Do you insist that nothing further can be done, Dr. Calvin?"

"I can't think of anything, sir," she replied, wearily. "If there were only other differences between Nestor 10 and the normal robots, differences that didn't involve the First Law. Even one other difference. Something in impressionment, environment, specification—" And she stopped suddenly.

"What is it?"

"I've thought of something . . . I think—" Her eyes grew distant and hard, "These modified Nestors, Peter? They get the same impressioning the normal ones get, don't they?"

"Yes. Exactly the same."

"And what was it you were saying, Mr. Black," she turned to the young man, who through the storms that had followed his news had maintained a discreet silence. "Once when complaining of the Nestors' attitude of superiority, you said the technicians had taught them all they knew."

"Yes, in etheric physics. They're not acquainted with the subject when they come here."

"That's right," said Bogert, in surprise. "I told you, Susan, when I spoke to the other Nestors here that the two new arrivals hadn't learned etheric physics yet."

"And why is that?" Dr. Calvin was speaking in mounting excitement. "Why aren't NS-2 models impressioned with etheric physics to start with?"

"I can tell you that," said Kallner. "It's all of a piece with the secrecy.

We thought that if we made a special model with knowledge of etheric physics, used twelve of them, and put the others to work in an unrelated field, there might be suspicion. Men working with normal Nestors might wonder why they knew etheric physics. So there was merely an impressionment with a capacity for training in the field. Only the ones that come here, naturally, receive such a training. It's that simple."

"I understand. Please get out of here, the lot of you. Let me have an hour or so."

Calvin felt she could not face the ordeal for a third time. Her mind had contemplated it and rejected it with an intensity that left her nauseated. She could face that unending file of repetitious robots no more.

So Bogert asked the questions now, while she sat aside, eyes and mind half-closed.

Number Fourteen came in—forty-nine to go.

Bogert looked up from the guide sheet and said, "What is your number in line?"

"Fourteen, sir." The robot presented his numbered ticket.

"Sit down, boy."

Bogert asked, "You haven't been here before on this day?"

"No, sir."

"Well, boy, we are going to have another man in danger of harm soon after we're through here. In fact, when you leave this room, you will be led to a stall where you will wait quietly, till you are needed. Do you understand?"

"Yes, sir."

"Now, naturally, if a man is in danger of harm, you will try to save him."

"Naturally, sir."

"Unfortunately, between the man and yourself, there will be a gamma ray field." * *

Silence.

"Do you know what gamma rays are?" asked Bogert sharply.

"Energy radiation, sir?"

The next question came in a friendly, offhand manner, "Ever work with gamma rays?"

"No, sir." The answer was definite.

"Hm-m. Well, boy, gamma rays will kill you instantly. They'll destroy your brain. That is a fact you must know and remember. Naturally, you don't want to destroy yourself."

"Naturally." Again the robot seemed shocked. Then, slowly, "But, sir, if the gamma rays are between myself and the master that may be harmed, how can I save him? I would be destroying myself to no purpose."

"Yes, there is that." Bogert seemed concerned about the matter. "The only thing I can advise, boy, is that if you detect the gamma radiation between yourself and the man, you may as well sit where you are."

The robot was openly relieved. "Thank you, sir. There wouldn't be any use, would there?"

"Of course not. But if there *weren't* any dangerous radiation, that would be a different matter."

"Naturally, sir. No question of that."

"You may leave now. The man on the other side of the door will lead you to your stall. Please wait there."

He turned to Susan Calvin when the robot left. "How did that go, Susan?"

"Very well," she said, dully.

"Do you think we could catch Nestor 10 by quick questioning on etheric physics?"

"Perhaps, but it's not sure enough." Her hands lay loosely in her lap. "Remember, he's fighting us. He's on his guard. The only way we can catch him is to outsmart him—and, within his limitations, he can think much more quickly than a human being."

"Well, just for fun — suppose I ask the robots from now on a few questions on gamma rays. Wave length limits, for instance."

"No!" Dr Calvin's eyes sparked to life. "It would be too easy for him to deny knowledge and then he'd be warned against the test that's coming up — which is our real chance. Please follow the questions I've indicated, Peter, and don't improvise. It's just within the bounds of risk to ask them if they've ever worked with gamma rays. And try to sound even less interested than you do when you ask it."

Bogert shrugged, and pressed the buzzer that would allow the entrance of Number Fifteen.

The large Radiation Room was in readiness once more. The robots waited patiently in their wooden cells, all open to the center but closed off from each other.

Major general Kallner mopped his brow slowly with a large handkerchief while Dr. Calvin checked the last details with Black.

"You're sure now," she demanded, "that none of the robots have had a chance to talk with each other after leaving the Orientation Room?"

"Absolutely sure," insisted Black. "There's not been a word exchanged."

"And the robots are put in the proper stalls?"

"Here's the plan."

The psychologist looked at it thoughtfully, "Um-m-m."

The general peered over her shoulder. "What's the idea of the arrangement, Dr. Calvin?"

"I've asked to have those robots that appeared even slightly out of true in the previous tests concentrated on one side of the circle. I'm going to be sitting in the center myself this time, and I wanted to watch those particularly."

"*You're* going to be sitting there—" exclaimed Bogert.

"Why not?" she demanded coldly. "What I expect to see may be something quite momentary. I can't risk having anyone else as main observer. Peter, you'll be in the observing booth, and I want you to keep your eye on the opposite side of the circle. General Kallner, I've arranged for motion pictures to be taken of each robot, in case visual observation isn't enough. If these are required, the robots are to remain exactly where they are until the pictures are developed and studied. None must leave,

none must change place. Is that clear?"

"Perfectly."

"Then let's try it this one last time."

Susan Calvin sat in the chair, silent, eyes restless. A weight dropped, crashed downward, then pounded aside at the last moment under the synchronized thump of a sudden force beam.

And a single robot jerked upright and took two steps.

And stopped.

But Dr. Calvin was upright, and her finger pointed to him sharply. "Nestor 10, come here," she cried. "*come here!* COME HERE!"

Slowly, reluctantly, the robot took another step forward.

The psychologist shouted at the top of her voice, without taking her eyes from the robot, "Get every other robot out of this place, somebody. Get them out quickly, and *keep* them out."

Somewhere within reach of her ears there was noise, and the thud of hard feet upon the floor. She did not look away.

Nestor 10—if it was Nestor 10—took another step, and then, under force of her imperious gesture, two more. He was only ten feet away, when he spoke harshly, "I have been told to be lost—"

Another step. "I must not disobey. They have not found me so far— He would think me a failure— He told me— But it's not so— I am powerful and intelligent—"

The words came in spurts.

Another step. "I know a good deal— He would think . . . I mean I've been found— Disgraceful— Not I— I am intelligent— And by just a master . . . who is weak— Slow—"

Another step—and one metal arm flew out suddenly to her shoulder, and she felt the weight bearing her down. Her throat constricted, and she felt a shriek tear through.

Dimly, she heard Nestor 10's next words, "No one must find me. No master—" and the cold metal was against her, and she was sinking under the weight of it.

And then a queer, metallic sound, and she was on the ground with an unfelt thump, and a gleaming arm was heavy across her body. It did not move. Nor did Nestor 10, who sprawled beside her.

And now faces were bending over her.

Gerald Black was gasping, "Are you hurt, Dr. Calvin?"

She shook her head feebly. They pried the arm off her and lifted her gently to her feet, "What happened?"

Black said, "I bathed the place in gamma rays for five seconds. We didn't know what was happening. It wasn't till the last second that we realized he was attacking you, and then there was no time for anything but a gamma field. He went down in an instant. There wasn't enough to harm you though. Don't worry about it."

"I'm not worried." She closed her eyes and leaned for a moment upon his shoulder. "I don't think I was attacked exactly. Nestor 10 was simply *trying* to do so. What was

left of the First Law was still holding him back."

"You're sure it was Nestor 10?" asked the general, eagerly.

"Oh, yes. No possible doubt."

Susan Calvin and Peter Bogert, two weeks after their first meeting with Major general Kallner had their last. Work at Hyper Base had been resumed. The trading ship with its sixty-two normal NS-2's was gone to wherever it was bound, with an officially-imposed story to explain its two weeks' delay. The government cruiser was making ready to carry the two roboticists back to Earth.

Kallner was once again a-gleam in dress uniform. His white gloves shone as he shook hands.

Calvin said, "The other modified Nestors are, of course, to be destroyed."

"They will be. We'll make shift with normal robots, or, if necessary, do without."

"Good."

"But tell me— You haven't explained— How was it done?"

She smiled tightly, "Oh, that. I would have told you in advance if I had been more certain of its working. You see, Nestor 10 had a superiority complex that was becoming more radical all the time. He liked to think that he and other robots knew more than human beings. It was becoming very important for him to think so.

"We knew that. So we warned every robot in advance that gamma rays would kill them, which it would, and we further warned them all that gamma rays would be between them and myself. So they all stayed where they were, naturally. By Nestor 10's own logic in the previous test they had all decided that there was no point in trying to save a human being if they were sure to die before they could do it."

"Well, yes, Dr. Calvin, I understand that. But why did Nestor 10 himself leave his seat."

"Ah! That was a little arrangement between myself and your young Mr. Black. You see it wasn't gamma rays that flooded the area between myself and the robots—but infrared rays. Just ordinary heat rays, absolutely harmless. Nestor 10 knew they were infrared and harmless and so he began to dash out, as he expected the rest would do, under First Law compulsion. It was only a fraction of a second too late that he remembered that the normal NS-2's could detect radiation, but could not identify the type. That he himself could only identify wave lengths by virtue of the training he had received at Hyper Base. To the normal robots the area was fatal because we had told them it would be, and only Nestor 10 knew we were lying.

"And for just a moment he forgot, or didn't want to remember, that other robots might be more ignorant than human beings, and his superiority caught him. Good-by, general."

THE END.

BRASS TACKS

Open letter to Lewis Padgett?

Dear Mr. Campbell:

"The time has come, the walrus said,
to speak of many things. . . .
And why the sea is boiling hot,
and whether pigs have wings."

The reason for this letter is to get a lot of things off my chest. In the first place, let me comment on generalities. The outside of the magazine is becoming better and better, though I long for a return to the larger size of yesteryears. Timmins is still as good as ever. The interior art work, as cynics have long since pointed out, stinks.

The stories of late have been on the definite upgrade. During the spring and summer of this year there were astoundingly few good tales. I suppose that the ebb had gone out, and now is coming in again. For instance, take Simak's "Hobbies" in the November issue. Perhaps because I'm a psychologist it interested me particularly, but the writing was up to par, too. As for Chandlers' "Tower of Darkness," in the same issue, all I can say is that it is a novel departure from the regular ASF stories. Sex is usually well played down. Syntax good, howsomeever. "The Chronicler" was not up to Van Vogt's standards. His latest "Out of Gods" tale in the December issue was the best of that series, and was only nosed out of first place by the general excellence of "Metamorphosite," which was a humdinger of a tale.

The quote at the top of the other page is a hint to Padgett, who seems to love Carroll as much as I do. Winged pigs ought to make a pretty decent subject for a story, *n'est-ce pas?* Also tell him I'm awaiting another "Baldy" story.

I was glad to see your article on the A bomb, which I was quite incapable of doing. As I said last summer, I'm a Psychologist, not a physical scientist. However, since I'm so closely related to the bomb—I still have many friends at Los Alamos—in a semiprofessional way, any material on it makes for good reading, so far as I can compre-

hend it.—James McConnell, Baton Rouge, Louisiana.

Phor Philly Phairs.

Dear Mr. Campbell:

All science fiction fans residing in the Philadelphia area are cordially invited to join the Philadelphia Science Fiction Society. We have our own clubroom where members can meet at any time to discuss their favorite pastime, and dues are at a minimum. Many of our members are well known writers, such as A. M. Phillips, L. Sprague de Camp, and George O. Smith. Each meeting is made interesting by talks and discussions on the various phases of science and science fiction. For instance the past three meetings featured de Camp on extra-dimensions, Phillips on Anthropology, and Smith on energy weapons.

The PSFS is one of the largest fan groups in the country, and is the organization which will sponsor the 1947 World Science Fiction Convention. Come on, fellows, get acquainted with the gang!—Robert A. Madle, Secretary, 1366 E. Columbia Ave., Phila., 25, Pa.

Of course, it doesn't really matter much which end of an artillery shell hits you if it hits you—

Mr. Campbell:

Projectiles and trajectories fit my business well, I am Gunnery Officer aboard a heavy cruiser. In reply to the letter of Mr. J. Shelton in your September issue here are the answers to the majority of his questions.

1. The nose does come down on a properly designed shell because of precession about the axis which is horizontal and at right angles to the line of fire. The precession, following the right-hand rule, is caused by the "piling up" of air on the forward right-hand portion of projectile which exerts the precessing force. This is for the conventional rifling giving the projectile a right-hand twist or "spin." The precession is manifested by an oscillation about the path of the projectile by the nose, thereby producing a wobble. Each oscillation brings the nose of the projectile a small amount further down than it will return it, the additive effect giving us a projectile that is always approximately parallel—the longitudinal axis—to an instantaneous extension of its own path. The statement made by Mr. Shelton concerning airfoil action is falacious. Many of the other side comments are unnecessary, i.e., his statement concerning centrifugal force.

2. A conventional projectile fired at an angle of elevation of eighty-five degrees will "tumble" that is, end for end after passing its maximum ordinate. This phenomena is frequently apparent to the human eye, particularly in major caliber guns having had excessive wear. This "critical angle" will differ for all projectiles and is a function of several variables which have no place in an elementary discussion such as this. It suffices to say that

a projectile can be designed which is essentially perfect for a fixed angle of elevation and a given amount of "twist." Deviation from this angle produces varying degrees of erratic performance.

3. Question three is not clearly stated. It is difficult to compare a hypothetical chart with a factor and then entertain the notion that either or both "allows" for something described simply as "departure of axis of shell from horizontal flight." This statement carries no meaning to me, however I am certain that whatever value Mr. Shelton is trying to ascertain I can determine with the means normally at my disposal.

4. (partially covered in item 2.) The angle desired is the "critical angle" above which the projectile will oscillate violently and tumble end over end. Since the projectile is rotating about its athwartships axis, the nose will be in a position to hit approximately forty per cent of the time, ergo, the proper answer to question four is, "there is no angle where this statement becomes completely true." The portion of the question concerning the fuse ignores the fact that there are many types of fuses designed for various purposes.

Any standard reference on exterior ballistics will substantiate the foregoing.

In closing I wish to say I find your magazine most stimulating. It exercises one's imagination and further instills an alertness toward probabilities of the future notably enhanced by the awareness of your authors in their blending of science with a reasonable psychology and the introduction of "semantics" along with the other standard science fiction concepts. Frankly, I enjoy the flights of fantasy as long as I do not overindulge.—D. E. Zook, Lieutenant Commander, United States Navy.

Well, house ads do fill in those empty corners!

Dear JWC:

September is a hard issue to rate, what with three articles, two of them rather off-trail, and five pieces of fiction which are pretty much of a muchness. Practically, you might as well call it an eight-way tie. The September, 1945 issue also was so hard to rate that I think I finally gave up on it. But with the reservation that I might, two weeks from now, rate these items in exact reverse order, here it is.

1. "Vintage Season," O'Donnell. Another of those unearthly things, of the intrusion of alienness on the background of the familiar, in tone rather like "The Children's Hour" and "The Code," but this time a little more definite and understandable in the dénouement and not so vague and metaphysical. I never can decide whether I like them or not, but this was welcome anyhow for the sake of variety.

2. "The Toymaker," Jones. Nice enough as a story, though by no means of "Fifty Million Monkeys" caliber. However, it has some weaknesses as a general solution to the problem of abolishing war—supposing the Imagino material to

be attainable or theoretically possible. For one thing, the circumstances were highly specialized: one warlike world—region, sector, nation—with the rest of the consequently adjacent cosmos peacefully inclined. It is hardly likely that in practice an aggressive political unit, with the suspicious, distrustful, isolationist tendencies to be expected, would permit any such devices to be planted by commerce from *without* —granting a psychology sufficiently similar that the gadgets *could* work —and no one with such heretical convictions *within* a solidly established totalitarian system is likely to be tolerated in a position from which a general distribution could be effected.

Furthermore, I regard fear as about the unhealthiest possible motivation. It can conceivably bring about worthwhile results, but even so it is likely to have some very nasty by-products. A sudden scare in personal emergencies can induce life-saving evasive or defensive action, but pervasive abiding terror is likely to lead to insane or unsane hysterical responses—or more likely to a simple refusal to believe the facts.

3. "Evidence," Asimov. Nice idea. This isn't quite topnotch Asimov, but the guy hardly ever turns out a really bad story.

4. "Congress is too Busy," deGraeff. I was tempted to rate this first as a sign of approbation of your pioneering such material in a science-fiction magazine, but it isn't intrinsically outstanding. This atomic business needs clear-eyed, fearless, candid treatment more than anything else before in history. Keep it up—I approve in principle even when I disagree in detail.

5. "Second Approximation," Richardson. Just why I don't know, but this interested me far less than "Space Fix." I guess my primary objection is that it is still too artificial a case owing to the assumption that escape velocity would be acquired instantaneously, with subsequent flight unpowered.

6. "Slaves of the Lamp," Zagat. Not a very convincing story, somehow. Most of the characters never become more than mere names.

7. "Meihem in ce Klasrum," Edwards. This and other recent items concerning alphabets and phonetics require extended comment, which I hope to render in a later letter.

8. "Blind Time," Smith. No complaint.

And may I say once more that Swenson is an atrocious illustrator? I may? Thanks. Kildale is one of the very few worse ones. Primitive art may have its place, but let's not clutter up the nice clean pages of ASF with it, shall we? If Swenson is the best available, let's just omit the illustrations. That would settle a lot of arguments and improve the looks of the magazine, too.

Now how about dropping those house ads? They louse up the works even worse than the other ads and bum drawings, and the possibility that they can sell any ASF readers on other S & S pulps is astronomically remote.—C. Burton Stevenson, 521 E. Monroe, Phoenix, Arizona.

BOOK REVIEW

THE TIME STREAM by John Taine

Buffalo Book Co., $3.00

It is an anomaly of our scientific age that science fiction is less respectable in the eyes of literary critics and of the general reader than are tales of the frankly supernatural. A good argument could be made for the point of view that ghosts, witches, and the other denizens of nightmare are actually a very solid part of our cultural heritage, and that the average person has far more reason to believe in their reality than in this upstart newcomer, science.

It has taken the atomic bomb to bring the modern literature of science out of the pulp magazines and into the respectable dress of a pair of hard covers and a dust jacket. Even so, the average reviewer is not giving the new science fiction anthologies the same serious consideration which he grants the latest ghost-story omnibus. It is my own guess that science fiction will not really come into its own until someone lands on the Moon or Mars and the whole vast realm of interplanetary imagining, which the critics still dismiss as "Buck Rogers trash" while they pay grudging tribute to predictions of atomic war, suddenly is hard fact.

During the late 1920's, when the first science fiction magazines were opening a new realm of literature, one man was giving the lie to the rule-of-thumb that science fiction has no place in a publisher's trade list. This man was and is the distinguished mathematician of the California Institute of Technology, Professor Eric Temple Bell. His pen name is John Taine, and few students of science fiction will deny that his books are landmarks in their field. With A. Merritt, whose novels are really more fantasy than science, John Taine made the '20s stand out.

The first Taine book, "The Purple Sapphire," was published by Dutton in 1924. Five more books appeared under the Dutton imprint: "Quayle's Invention" and "The Gold Tooth" in 1927, "Green Fire" in 1928, "The Greatest Adventure" in 1929, and "The Iron Star"—greatest of them all—in 1930. One more book—actually fictionized science rather than science fiction—was brought out by a scientific publisher, Williams and Wilkins, in 1934—"Before the Dawn." And that, so far as readers of books are concerned, was the end of John Taine.

Merritt's novels had all appeared as serials before publication, but an oddity about John Taine, even at the time of his greatest popularity, has been the fact that—until very recently—none of his published books had appeared in a magazine, and none of his magazine stories was published in book form. Now, fif-

teen years after it was serialized, the jinx is broken and Taine's "The Time Stream" has been put between covers by a new publishing house which seems destined to do for science fiction what Arkham House has done for the weird tale.

"The Time Stream" is by all odds the strangest of all John Taine's novels. So far as I can recall, it was the first story to develop the now familiar concept of Time as a flowing stream into which one may plunge, to swim forward into the future or back into the past. Rumor has it that this was his first novel, and this may be true for to a certain extent it lacks the craftmanship of his later books, and the characterization which to me makes "The Iron Star" one of the great science fiction novels of all time. Even so, the Taine touch and the soaring Taine imagination are there, and with them a network of mystery which is not developed so strongly in any of his other books—except, perhaps, "The Iron Star."

It would not be possible to describe the plot of "The Time Stream" to any extent without destroying much of this mystery as it is developed in the early chapters of the book. Suffice it to say that the story introduces a group of associates at the turn of the present century who are disturbed by seemingly identical memories of other places and other times than ours. The book is the story of the strange way in which they found the reason for these memories in the stream of Time, and in worlds strewn through the immensity of a closed but boundless universe in which "The Whole Is One."

If "The Time Stream" is less powerful than some of John Taine's other books, it is because he tries to do too much—because there are too many leading characters for any one to stand out. For me, at least, there is a double impact in some of the implied but never stated relationships between our own Earth, the dawn-world Eos, and the desert-world of the far past.

Buffalo Book Company—now Hadley Publishing Company of Providence, R. I.—intends to give us all of John Taine's unpublished novels in book form. There are few greater services they can perform for a generation of magazine readers who know not Taine. My own nomination for the next in the series would be "1287" or "Seeds of Life," for they may well be mirrored in headlines before they can be put between covers.

Physically, "The Time Stream" is a step ahead of the Hadley edition of "Skylark of Space," reviewed here recently, but not quite up to the tough standard set by August Derleth and his Arkham House series. The binding I like better, and the jacket is closer to professional standards than that for "Skylark," but there are too many typographical errors, some of which confuse the text. There are better ways of writing jacket-blurbs than quoting a stray passage from the novel—particularly if new readers are to be attracted to it.

P. Schuyler Miller.

Somebody slipped in the delivery service, and the Christmas present arrived a few score years earlier than it should have. The Bild-A-Man set might be fine for future kids—but not now.

CHILD'S PLAY

BY WILLIAM TENN

Illustrated by Cartier.

After the man from the express company had given the door an untipped slam, Sam Weber decided to move the huge crate under the one light bulb in his room. It was all very well for the messenger to drawl, "I dunno. We don't send 'em; we just deliver 'em, mister"—but there must be some mildly lucid explanation.

With a grunt that began as an anticipatory reflex and ended on a note of surprised annoyance, Sam shoved the box forward the few feet necessary. It was heavy enough; he wondered how the messenger had carried it up the three flights of stairs.

He straightened and frowned down at the garish card which contained his name and address as well as the legend—"Merry Christmas, 2153."

A joke? He didn't know anyone who'd think it funny to send a card dated over two hundred years in the future. Unless one of the comedians in his law school graduating class meant to record his opinion as to

when Weber would be trying his first case. Even so—

The letters were shaped strangely. come to think of it, sort of green streaks instead of lines. And the card was a sheet of gold!

Sam decided he was really interested. He ripped the card aside, tore off the flimsy wrapping material—and stopped. He whistled. Then he gulped.

"Well clip my ears and call me streamlined!"

There was no top to the box, no slit in its side, no handle anywhere in sight. It seemed to be a solid, cubical mass of brown stuff. Yet he was positive something had rattled inside when it was moved.

He seized the corners and strained and grunted till it lifted. The underside was as smooth and innocent of opening as the rest. He let it thump back to the floor.

"Ah, well," he said, philosophically, "it's not the gift; it's the principle involved."

Many of his gifts still required appreciative notes. He'd have to work up something special for Aunt Maggie. Her neckties were things of cubistic horror, but he hadn't even sent her a lone handkerchief this Christmas. Every cent had gone into buying that brooch for Tina. Not quite a ring, but maybe she'd consider that under the circumstances—

He turned to walk to his bed which he had drafted into the additional service of desk and chair. He kicked at the great box disconsolately. "Well, if you won't open, you won't open."

As if smarting under the kick, the box opened. A cut appeared on the upper surface, widened rapidly and folded the top back and down on either side like a valise. Sam clapped his forehead and addressed a rapid prayer to every god from Set to Father Divine. Then he remembered what he'd said.

"Close," he suggested.

The box closed, once more as smooth as a baby's anatomy.

"Open."

The box opened.

So much for the sideshow, Sam decided. He bent down and peered into the container.

The interior was a crazy mass of shelving on which rested vials filled with blue liquids, jars filled with red solids, transparent tubes showing yellow and green and orange and mauve and other colors which Sam's eyes didn't quite remember. There were seven pieces of intricate apparatus on the bottom which looked as if tube-happy radio hams had assembled them. There was also a book.

Sam picked the book off the bottom and noted numbly that while all its pages were metallic, it was lighter than any paper book he'd ever held.

He carried the book over to the bed and sat down. Then he took a long, deep breath and turned to the first page. "Gug," he said, exhaling his long, deep breath.

In mad, green streaks of letters:

Bild-A-Man Set #3. This set is intended solely for the uses of children between the ages of eleven and thirteen. The equipment, much more advanced than Bild-A-Man Sets 1 and 2, will enable the

child of this age-group to build and assemble complete adult humans in perfect working order. The retarded child may also construct the babies and mannikins of the earlier kits. Two disassembleators are provided so that the set can be used again and again with profit. As with Sets 1 and 2, the aid of a Census Keeper in all disassembling is advised. Refills and additional parts may be acquired from The Bild-A-Man Company, 928 Diagonal Level, Glunt City, Ohio. Remember—only with a Bild-A-Man can you build a man!

Weber slammed his eyes shut. What was that gag in the movie he'd seen last night? Terrific gag. Terrific picture, too. Nice technicolor. Wonder how much the director made a week? The cameraman? Five hundred? A thousand?

He opened his eyes warily. The box was still a squat cube in the center of his room. The book was still in his shaking hand. And the page read the same.

"Only with a Bild-A-Man can you build a man!" Heaven help a neurotic young lawyer at a time like this!

There was a price list on the next page for "refills and additional parts." Things like one liter of hemoglobin and three grams of assorted enzymes were offered for sale in terms of one slunk fifty and three slunks forty-five. A note on the bottom advertised Set #4: "The thrill of building your first live Martian!"

Fine print announced *pat. pending 2148.*

The third page was a table of contents. Sam gripped the edge of the mattress with one sweating hand and read:

Sam dropped the book back into the box and ran for the mirror. His face was still the same, somewhat like bleached chalk, but fundamentally the same. He hadn't twinned or grown himself a mannikin or devised a new kind of life for his leisure moments. Everything was snug as a bug in a bughouse.

Very carefully he pushed his eyes back into their proper position in their sockets.

"Dear Aunt Maggie," he began writing feverishly. "Your ties made the most beautiful gift of my Christmas. My only regret is—"

My only regret is that I have but one life to give for my Christmas present. Who could have gone to such fantastic lengths for a practical joke? Lew Knight? Even Lew must have some reverence in his insensitive body for the institution of Christmas. And Lew didn't have the brains or the patience for a job so involved.

Tina? Tina had the fine talent for complication, all right. But Tina,

while possessing a delightful abundance of all other physical attributes, was sadly lacking in funnybone.

Sam drew the leather envelope forth and caressed it. Tina's perfume seemed to cling to the surface and move the world back into focus.

The metallic greeting card glinted at him from the floor. Maybe the reverse side contained the sender's name. He picked it up, turned it over.

Nothing but blank gold surface. He was sure of the gold; his father had been a jeweler. The very value of the sheet was rebuttal to the possibility of a practical joke. Besides, again, what was the point?

"Merry Christmas, 2153." Where would humanity be in two hundred years? Traveling to the stars, or beyond—to unimaginable destinations? Using little mannikins to perform the work of machines and robots? Providing children with—

There might be another card or note inside the box. Weber bent down to remove its contents. His eye noted a large grayish jar and the label etched into its surface: *Dehydrated Neurone Preparation, for human construction only.*

He backed away and glared. "Close!"

The thing melted shut. Weber sighed his relief at it and decided to go to bed.

He regretted while undressing that he hadn't thought to ask the messenger the name of his firm. Knowing the delivery service involved would be useful in tracing the origin of this gruesome gift.

"But then," he repeated as he fell asleep, "it's not the gift — it's the principle! Merry Christmas, me."

The next morning when Lew Knight breezed in with his "Good morning, counselor," Sam waited for the first sly ribbing to start. Lew wasn't the man to hide his humor behind a bushel. But Lew buried his nose in "The New York State Supplement" and kept it there all morning. The other five young lawyers in the communal office appeared either too bored or too busy to have Bild-A-Man sets on their conscience. There were no sly grins, no covert glances, no leading questions.

Tina walked in at ten o'clock, looking like a pin-up girl caught with her clothes on.

"Good morning, counselors," she said.

Each in his own way, according to the peculiar gland secretions he was enjoying at the moment, beamed, drooled or nodded a reply. Lew Knight drooled. Sam Weber beamed.

Tina took it all in and analyzed the situation while she fluffed her hair about. Her conclusions evidently involved leaning markedly against Lew Knight's desk and asking what he had for her to do this morning.

Sam bit savagely into Hackleworth "On Torts." Theoretically, Tina was employed by all seven of them as secretary, switchboard operator and receptionist. Actually, the most faithful performance of her duties entailed nothing more daily than the typing and addressing of two envelopes with an occasional letter to be sealed inside. Once a week there

might be a wistful little brief which was never to attain judicial scrutiny. Tina therefore had a fair library of fashion magazines in the first drawer of her desk and a complete cosmetics laboratory in the other two; she spent one third of her working day in the ladies' room swapping stocking prices and sources with other secretaries; she devoted the other two thirds religiously to that one of her employers who as of her arrival seemed to be in the most masculine mood. Her pay was small but her life was full.

Just before lunch, she approached casually with the morning's mail. "Didn't think we'd be too busy this morning, counselor—" she began.

"You thought incorrectly, Miss Hill," he informed her with a brisk irritation that he hoped became him well; "I've been waiting for you to terminate your social engagements so that we could get down to what occasionally passes for business."

She was as startled as an uncushioned kitten. "But — but this isn't Monday. Somerset & Ojack only send you stuff on Mondays."

Sam winced at the reminder that if it weren't for the legal drudgework he received once a week from Somerset & Ojack he would be a lawyer in name only, if not in spirit only. "I have a letter, Miss Hill," he replied steadily. "Whenever you assemble the necessary materials, we can get on with it."

Tina returned in a head-shaking moment with stenographic pad and pencils.

"Regular heading, today's date," Sam began. "Address it to Chamber of Commerce, Glunt City, Ohio. Gentlemen: Would you inform me if you have registered currently with you a firm bearing the name of the Bild-A-Man Company or a firm with any name at all similar? I am also interested in whether a firm bearing the above or related name has recently made known its intention of joining your community. This inquiry is being made informally on behalf of a client who is interested in a product of this organization whose address he has mislaid. Signature and then this P.S.—My client is also curious as to the business possibilities of a street known as Diagonal Avenue or Diagonal Level. Any data on this address and the organizations presently located there will be greatly appreciated."

Tina batted wide blue eyes at him. "Oh, Sam," she breathed, ignoring the formality he had introduced, "Oh, Sam, you have another client. I'm so glad. He looked a little sinister, but in *such* a distinguished manner that I was certain—"

"Who? Who looked a little sinister?"

"Why your new cli-ent." Sam had the uncomfortable feeling that she had almost added "stu-pid." "When I came in this morning, there was this terribly tall old man in a long black overcoat talking to the elevator operator. He turned to me—the elevator operator, I mean—and said, 'This is Mr. Weber's secretary. She'll be able to tell you anything you want to know.' Then he sort of winked which I thought was sort of impolite, you know, considering. Then this old man looked at me hard

and I felt distinctly uncomfortable and he walked away muttering, 'Either disjointed or predatory personalities. Never normal. Never balanced.' Which I didn't think was very polite, either, I'll have you know, if he *is* your new client!" She sat back and began breathing again.

Tall, sinister old men in long, black overcoats pumping the elevator operator about him. Hardly a matter of business. He had no skeletons in his personal closet. Could it be connected with his unusual Christmas present? Sam hmmmed mentally.

"—but she is my favorite aunt, you know," Tina was saying. "And she came in so unexpectedly."

The girl was explaining about their Christmas date. Sam felt a rush of affection for her as she leaned forward.

"Don't bother," he told her. "I knew you couldn't help breaking the date. I was a little sore when you called me, but I got over it; never-hold-a-grudge-against-a-pretty-girl Sam, I'm known as. How about lunch?"

"Lunch?" She flew distress signals. "I promised Lew, Mr. Knight, that is— But he wouldn't mind if you came along."

"Fine. Let's go." This would be helping Lew to a spoonful of his own annoying medicine.

Lew Knight took the business of having a crowd instead of a party for lunch as badly as Sam hoped he would. Unfortunately, Lew was able to describe details of his forthcoming case, the probable fees and possible distinction to be reaped thereof. After one or two attempts to bring an interesting will he was rephrasing for Somerset & Ojack into the conversation, Sam subsided into daydreams. Lew immediately dropped Rosenthal vs. Rosenthal and leered at Tina conversationally.

Outside the restaurant, snow discolored into slush. Most of the stores were removing Christmas displays. Sam noticed construction sets for children, haloed by tinsel and glittering with artificial snow. Build a radio, a skyscraper, an airplane. But "Only with a Bild-A-Man can you—"

"I'm going home," he announced suddenly. "Something important I just remembered. If anything comes up, call me there."

He was leaving Lew a clear field, he told himself, as he found a seat on the subway. But the bitter truth was that the field was almost as clear when he was around as when he wasn't. Lupine Lew Knight, he had been called in Law School; since the day when he had noticed that Tina had the correct proportions of dress-filling substance, Sam's chances had been worth a crowbar at Fort Knox.

Tina hadn't been wearing his brooch today. Her little finger, right hand, however, had sported an unfamiliar and garish little ring. "Some got it," Sam philosophized. "Some don't got it. I don't got it."

But it would have been nice, with Tina, to have "got it."

As he unlocked the door of his room he was surprised by an unmade bed telling with rumpled stoicism of a chambermaid who'd never come. This hadn't happened be-

fore— Of course! He'd never locked his room before. The girl must have thought he wanted privacy.

Maybe he had.

Aunt Maggie's ties glittered obscenely at the foot of the bed. He chucked them into the closet as he removed his hat and coat. Then he went over to the washstand and washed his hands, slowly. He turned around.

This was it. At last the great cubical bulk that had been lurking quietly in the corner of his vision was squarely before him. It was there and it undoubtedly contained all the outlandish collection he remembered.

"Open," he said, and the box opened.

The book, still open to the metallic table of contents, was lying at the bottom of the box. Part of it had slipped into the chamber of a strange piece of apparatus. Sam picked both out gingerly.

He slipped the book out and noticed the apparatus consisted mostly of some sort of binoculars, supported by a coil and tube arrangement and bearing on a flat green plate. He turned it over. The underside was lettered in the same streaky way as the book. "Combination Electron Microscope and Workbench."

Very carefully he placed it on the floor. One by one, he removed the others, from the "Junior Biocalibrator" to the "Jiffy Vitalizer." Very respectfully he ranged against the box in five multi-colored rows the phials of lymph and the jars of basic cartilage. The walls of the chest were lined with indescribably thin and wrinkled sheets; a slight pressure along their edges expanded them into three-dimensional outlines of human organs whose shape and size could be varied with pinching any part of their surface—most indubitably molds.

Quite an assortment. If there was anything solidly scientific to it, that box might mean unimaginable wealth. Or some very useful publicity. Or—well, it should mean something!

If there was anything solidly scientific to it.

Sam flopped down to the bed and opened to "A Child's Garden Of Biochemistry."

At nine that night he squatted next to the Combination Electron Microscope and Workbench and began opening certain small bottles. At nine forty-seven Sam Weber made his first simple living thing.

It wasn't much, if you used the first chapter of Genesis as your standard. Just a primitive brown mold that, in the field of the microscope, fed diffidently on a piece of pretzel, put forth a few spores and died in about twenty minutes. But *he* had made it. He had constructed a specific life-form to feed on the constituents of a specific pretzel; it could survive nowhere else.

He went out to supper with every intention of getting drunk. After just a little alcohol, however, the *deüsh* feeling returned and he scurried back to his room.

Never again that evening did he recapture the exultation of the brown mold, though he constructed


CARTIER

a giant protein molecule and a whole slew of filterable viruses.

He called the office in the little corner drugstore which was his breakfast nook. "I'll be home all day," he told Tina.

She was a little puzzled. So was Lew Knight who grabbed the phone. "Hey, counselor, you building up a neighborhood practice? Kid Blackstone is missing out on a lot of cases. Two ambulances have already clanged past the building."

"Yeah," said Sam. "I'll tell him when he comes in."

The week end was almost upon him, so he decided to take the next day off as well. He wouldn't have any real work till Monday when the Somerset & Ojack basket would produce his lone egg.

Before he returned to his room, he purchased a copy of an advanced bacteriology. It was amusing to construct — with improvements!— uni-cellular creatures whose very place in the scheme of classification was a matter for argument among scientists of his own day. The Bild-A-Man manual, of course, merely gave a few examples and general rules; but with the descriptions in the bacteriology, the world was his oyster.

Which was an idea: he made a few oysters. The shells weren't hard enough, and he couldn't quite screw his courage up to the eating point, but they were most undeniably bivalves. If he cared to perfect his technique, his food problem would be solved.

The manual was fairly easy to follow and profusely illustrated with pictures that expanded into solidity as the page was opened. Very little was taken for granted; involved explanations followed simpler ones. Only the allusions were occasionally obscure—"This is the principle used in the phanphophlink toys", "When your teeth are next yokekkled or demortoned, think of the *Bacterium cyanogenum* and the humble part it plays", "If you have a rubicular mannikin around the house, you needn't bother with the chapter on mannikins".

After a brief search had convinced Sam that whatever else he now had in his apartment he didn't have a rubicular mannikin, he felt justified in turning to the chapter on mannikins. He had conquered completely this feeling of being Pop playing with Junior's toy train: already he had done more than the world's top biologists ever dreamed of for the next generation and what might not lie ahead—what problems might he not yet solve?

"Never forget that mannikins are constructed for one purpose and one purpose only." I won't, Sam promised. "Whether they are sanitary mannikins, tailoring mannikins, printing mannikins or even sunevviarry mannikins, they are each constructed with one operation of a given process in view. When you make a mannikin that is capable of more than one function, you are committing a crime so serious as to be punishable by public admonition."

"To construct an elementary mannikin—"

It was very difficult. Three times he tore down developing monstrosi-

ties and began anew. It wasn't till Sunday afternoon that the mannikin was complete—or rather, incomplete.

Long arms it had—although by an error, one was slightly longer than the other—a faceless head and a trunk. No legs. No eyes or ears, no organs of reproduction. It lay on his bed and gurgled out of the red rim of a mouth that was supposed to serve both for ingress and excretion of food. It waved the long arms, designed for some one simple operation not yet invented, in slow circles.

Sam, watching it, decided that life could be as ugly as an open field latrine in midsummer.

He had to disassemble it. Its length—three feet from almost boneless fingers to tapering, sealed-off trunk—precluded the use of the tiny disassembleator with which he had taken apart the oysters and miscellaneous small creations. There was a bright yellow notice on the large disassembleator, however—"To be used only under the direct supervision of a Census Keeper. Call formula A76 or unstable your *id*."

"Formula A76" meant about as much as "sunevviarry," and Sam decided his *id* was already sufficiently unstabled, thank you. He'd have to make out without a Census Keeper. The big disassembleator probably used the same general principles as the small one.

He clamped it to a bedpost and adjusted the focus. He snapped the switch set in the smooth underside.

Five minutes later the mannikin was a bright, gooey mess on his bed.

The large disassembleator, Sam was convinced as he tidied his room, did require the supervision of a Census Keeper. Some sort of keeper anyway. He rescued as many of the legless creature's constituents as he could, although he doubted he'd be using the set for the next fifty years or so. He certainly wouldn't ever use the disassembleator again; much less spectacular and disagreeable to shove the whole thing into a meat grinder and crank the handle as it squashed inside.

As he locked the door behind him on his way to a gentle binge, he made a mental note to purchase some fresh sheets the next morning. He'd have to sleep on the floor tonight.

Wrist-deep in Somerset & Ojack minutiae, Sam was conscious of Lew Knight's stares and Tina's puzzled glances. If they only knew, he exulted! But Tina would probably just think it "marr-vell-ouss!" and Lew Knight might make some crack like "Hey! Kid Frankenstein himself!" Come to think of it though Lew would probably have worked out some method of duplicating, to a limited extent, the contents of the Bild-A-Man set and marketing it commercially. Whereas he—well, there were other things you could do with the gadget. Plenty of other things.

"Hey, counselor," Lew Knight was perched on the corner of his desk, "what are these long week ends we're taking? You might not make as much money in the law, but does it look right for an associate of mine to sell magazine subscriptions on the side?"

Sam stuffed his ears mentally against the emery-wheel voice. "I've been writing a book."

"A law book? Weber 'On Bankruptcy'?"

"No, a juvenile. 'Lew Knight, The Neanderthal Nitwit.'"

"Won't sell. The title lacks punch. Something like 'Knights, Knaves and Knobheads' is what the public goes for these days. By the way, Tina tells me you two had some sort of understanding about New Year's Eve and she doesn't think you'd mind if I took her out instead. I don't think you'd mind either, but I may be prejudiced. Especially since I have a table reservation at Cigale's where there's usually less of a crowd of a New Year's Eve than at the automat."

"I don't mind."

"Good," said Knight approvingly as he moved away. "By the way, I won that case. Nice juicy fee, too. Thanks for asking."

Tina also wanted to know if he objected to the new arrangements when she brought the mail. Again, he didn't. Where had he been for over two days? He had been busy, very busy. Something entirely new. Something important.

She stared down at him as he separated offers of used cars guaranteed not to have been driven over a quarter of a million miles from caressing reminders that he still owed half the tuition for the last year of law school and when was he going to pay it?

Came a letter that was neither bill nor ad. Sam's heart momentarily lost interest in the monotonous round of pumping that was its lot as he stared at a strange postmark: Glunt City, Ohio.

Dear Sir:

There is no firm in Glunt City at the present time bearing any name similar to "Bild-A-Man Company" nor do we know of any such organization planning to join our little community. We also have no thoroughfare called "Diagonal"; our north-south streets are named after Indian tribes while our east-west avenues are listed numerically in multiples of five.

Glunt City is a restricted residential township; we intend to keep it that. Only small retailing and service establishlishments are permitted here. If you are interested in building a home in Glunt City and can furnish proof of white, Christian, Anglo-Saxon ancestry on both sides of your family for fifteen generations, we would be glad to furnish further information.

Thomas H. Plantagenet, Mayor

P.S. An airfield for privately owned jet- and propeller-driven aircraft is being built outside the city limits.

That was sort of that. He would get no refills on any of the vials and bottles even if he had a loose slunk or two with which to pay for the stuff. Better go easy on the material and conserve it as much as possible. But no disassembling!

Would the "Bild-A-Man Company" begin manufacturing at Glunt City some time in the future when it had developed into an industrial metropolis against the constricted wills of its restricted citizenry? Or had his package slid from some different track in the human time stream, some era to be born on an other-dimensional earth? There would have to be a common origin to both, else why the English word-

age? And could there be a purpose in his having received it, beneficial —or otherwise?

Tina had been asking him a question. Sam detached his mind from shapeless speculation and considered her quite-the-opposite features.

"So if you'd still like me to go out with you New Year's Eve, all I have to do is tell Lew that my mother expects to suffer from her gallstones and I have to stay home. Then I think you could buy the *Cigale* reservations from him cheap."

"Thanks a lot, Tina, but very honestly I don't have the loose cash right now. You and Lew make a much more logical couple anyhow."

Lew Knight wouldn't have done that. Lew cut throats with carefree zest. But Tina did seem to go with Lew as a type.

Why? Until Lew had developed a raised eyebrow where Tina was concerned, it had been Sam all the way. The rest of the office had accepted the fact and moved out of their path. It wasn't only a question of Lew's greater success and financial well-being: just that Lew had decided he wanted Tina and had got her.

It hurt. Tina wasn't special; she was no cultural companion, no intellectual equal; but he wanted her. He liked being with her. She was the woman he desired, rightly or wrongly, whether or not there was a sound basis to their relationship. He remembered his parents before a railway accident had orphaned him: they were theoretically incompatible, but they had been terribly happy together.

He was still wondering about it the next night as he flipped the pages of "Twinning yourself and your friends." It would be interesting to twin Tina.

"One for me, one for Lew."

Only the horrible possibility of an error was there. His mannikin had not been perfect: its arms had been of unequal length. Think of a physically lopsided Tina, something he could never bring himself to disassemble, limping extraneously through life.

And then the book warned: "Your constructed twin, though resembling you in every obvious detail, has not had the slow and guarded maturity you have enjoyed. He or she will not be as stable mentally, much less able to cope with unusual situations, much more prone to neurosis. Only a professional carnuplicator, using the finest equipment, can make an exact copy of a human personality. Yours will be able to live and even reproduce, but never to be accepted as a valid and responsible member of society."

Well, he could chance that. A little less stability in Tina would hardly be noticeable; it might be more desirable.

There was a knock. He opened the door, guarding the box from view with his body. His landlady.

"Your door has been locked for the past week, Mr. Weber. That's why the chambermaid hasn't cleaned the room. We thought you didn't want anyone inside."

"Yes." He stepped into the hall

and closed the door behind him. "I've been doing some highly important legal work at home."

"Oh." He sensed a murderous curiosity and changed the subject. "Why all the fine feathers, Mrs. Lipanti—New Year's Eve party?"

She smoothed her frilled black dress self-consciously. "Y-yes. My sister and her husband came in from Springfield today and we were going to make a night of it. Only . . . only the girl who was supposed to come over and mind their baby just phoned and said she isn't feeling well. So I guess we won't go unless somebody else, I mean unless we can get someone else to take care . . . I mean, somebody who doesn't have a previous engagement and who wouldn't—" Her voice trailed away in assumed embarrassment as she realized the favor was already asked.

Well, after all, he wasn't doing anything tonight. And she had been remarkably pleasant those times when he had had to operate on the basis of "Of course I'll have the rest of the rent in a day or so." But why did any one of the earth's two billion humans, when in the possession of an unpleasant buck, pass it automatically to Sam Weber?

Then he remembered Chapter IV on babies and other small humans. Since the night when he had separated the mannikin from its constituent parts, he'd been running through the manual as an intellectual exercise. He didn't feel quite up to making some weird error on a small human. But twinning wasn't supposed to be as difficult.

Only by Gog and by Magog, by Aesculapius the Physician and Kildare the Doctor, he would not disassemble this time. There must be other methods of disposal possible in a large city on a dark night. He'd think of something.

"I'd be glad to watch the baby for a few hours." He started down the hall to anticipate her polite protest. "Don't have a date tonight myself. No, don't mention it, Mrs. Lipanti. Glad to do it."

In the landlady's apartment, her nervous sister briefed him doubtfully. "And that's the only time she cries in a low, steady way so if you move fast there won't be much damage done. Not much, anyway."

He saw them to the door. "I'll be fast enough," he assured the mother. "Just so I get a hint."

Mrs. Lipanti paused at the door. "Did I tell you about the man who was asking after you this afternoon?"

Again? "A sort of tall, old man in a long, black overcoat?"

"With the most frightening way of staring into your face and talking under his breath. Do you know him?"

"Not exactly. What did he want?"

"Well, he asked if there was a Sam Weaver living here who was a lawyer and had been spending most of his time in his room for the past week. I told him we had a Sam Weber—your first name *is* Sam?—who answered to that description, but that the last Weaver had moved out over a year ago. He just looked at me for a while and said, 'Weaver, Weber — they might have made an

error,' and walked out without so much as a good-by or excuse me. Not what I call a polite gentleman."

Thoughtfully Sam walked back to the child. Strange how sharp a mental picture he had formed of this man! Possibly because the two women who had met him thus far had been very impressionable, although to hear their stories the impression was there to be received.

He doubted there was any mistake: the man had been looking for him on both occasions; his knowledge of Sam's vacation from foolscap this past week proved that. It did seem as if he weren't interested in meeting him until some moot point of identity should be established beyond the least shadow of a doubt. Something of a legal mind, that.

The whole affair centered around the "Bild-A-Man" set he was positive. This skulking investigation hadn't started until after the gift from 2153 had been delivered—and Sam had started using it.

But till the character in the long, black overcoat paddled up to Sam Weber personally and stated his business, there wasn't very much he could do about it.

Sam went upstairs for his Junior Biocalibrator.

He propped the manual open against the side of the bed and switched the instrument on to full scanning power. The infant gurgled thickly as the calibrator was rolled slowly over its fat body and a section of metal tape unwound from the slot with, according to the manual, a completely detailed physiological description.

It was detailed. Sam gasped as the tape, running through the enlarging viewer, gave information on the child for which a pediatrician would have taken out at least three mortgages on his immortal soul. Thyroid capacity, chromosome quality, cerebral content. All broken down into neat subheads of data for construction purposes. Rate of skull expansion in minutes for the next ten hours; rate of cartilage transformation; changes in hormone secretions while active and at rest.

This was a blueprint; it was like taking canons from a baby.

Sam left the child to a puzzled contemplation of its navel and sped upstairs. With the tape as a guide, he clipped sections of the molds into the required smaller sizes. Then, almost before he knew it consciously, he was constructing a small human.

He was amazed at the ease with which he worked. Skill was evidently acquired in this game; the mannikin had been much harder to put together. The matter of duplication and working from an informational tape simplified his problems, though.

The child took form under his eyes.

He was finished just an hour and a half after he had taken his first measurements. All except the vitalizing.

A moment's pause, here. The ugly prospect of disassembling stopped him for a moment, but he shook it off. He had to see how well he had done the job. If this child could breathe, what was not possible

to him! Besides he couldn't keep it suspended in an inanimate condition very long without running the risk of ruining his work and the materials.

He started the vitalizer.

The child shivered and began a low, steady cry. Sam tore down to the landlady's apartment again and scooped up a square of white linen left on the bed for emergencies. Oh well, some more clean sheets.

After he had made the necessary repairs, he stood back and took a good look at it. He was in a sense a papa. He felt as proud.

It was a perfect little creature, glowing and round with health.

"I have twinned," he said happily.

Every detail correct. The two sides of the face correctly unexact, the duplication of the original child's lunch at the very same point of digestion. Same hair, same eyes—or was it? Sam bent over the infant. He could have sworn the other was a blonde. This child had dark hair which seemed to grow darker as he looked.

He grabbed it with one hand and picked up the junior biocalibrator with the other.

Downstairs, he placed the two babies side by side on the big bed. No doubt about it. One was blonde; the other, his plagiarism, was now a definite brunette.

The biocalibrator showed other differences: Slightly faster pulse for his model. Lower blood count. Minutely higher cerebral capacity, although the content was the same. Adrenalin and bile secretions entirely unalike.

It added up to error. His child might be the superior specimen, or the inferior one, but he had not made a true copy. He had no way of knowing at the moment whether or not the infant he had built could grow into a human maturity. The other could.

Why? He had followed directions faithfully; had consulted the calibrator tape at every step. And this had resulted. Had he waited too long before starting the vitalizer? Or was it just a matter of insufficient skill?

Close to midnight, his watch delicately pointed out. It would be necessary to remove evidences of baby-making before the Sisters Lipanti came home. Sam considered possibilities swiftly.

He came down in a few moments with an old tablecloth and a cardboard carton. He wrapped the child in the tablecloth, vaguely happy that the temperature had risen that night, then placed it in the carton.

The child gurgled at the adventure. Its original on the bed *goo*ed in return. Sam slipped quietly out into the street.

Male and female drunks stumbled along tootling on tiny trumpets. People wished each other a *hic* happy new year as he strode down the necessary three blocks.

As he turned left, he saw the sign: "Urban Foundling Home." There was a light burning over a side door. Convenient, but that was a big city for you.

Sam shrank into the shadow of an

alley for a moment as a new idea occurred to him. This had to look genuine. He pulled a pencil out of his breast pocket and scrawled on the side of the carton in as small handwriting as he could manage:

Please take good care of my darling little girl. I am not married.

Then he deposited the carton on the doorstep and held his finger on the bell until he heard movement inside. He was across the street and in the alley again by the time a nurse had opened the door.

It wasn't until he walked into the boarding house that he remembered about the navel. He stopped and tried to recall. No, he had built his little girl without a navel! Her belly had been perfectly smooth. That's what came of hurrying! Shoddy workmanship.

There might be a bit of to-do in the foundling home when they unwrapped the kid. How would they explain it?

Sam slapped his forehead. "Me and Michelangelo. He adds a navel, I forget one!"

Except for an occasional groan, the office was fairly quiet the second day of the New Year.

He was going through the last intriguing pages of the book when he was aware of two people teetering awkwardly near his desk. His eyes left the manual reluctantly: "New kinds of life for your leisure moments" was really stuff!

Tina and Lew Knight.

Sam digested the fact that neither of them were perched on his desk.

Tina wore the little ring she'd received for Christmas on the third finger of her left hand; Lew was experimenting with a sheepish look and finding it difficult.

"Oh, Sam. Last night, Lew... Sam, we wanted you to be the first—Such a surprise, like that I mean! Why I almost—Naturally we thought this would be a little difficult . . . Sam, we're going, I mean we expect—"

"—to be married," Lew Knight finished in what was almost an undertone. For the first time since Sam had known him he looked uncertain and suspicious of life, like a man who finds a newly-hatched octopus in his breakfast orange juice.

"You'd adore the way Lew proposed," Tina was gushing. "So roundabout. And so shy. I told him afterwards that I thought for a moment he was talking of something else entirely. I did have trouble understanding you, didn't I dear?"

"Huh? Oh yeah, you had trouble understanding me." Lew stared at his former rival. "Much of a surprise?"

"Oh, no. No surprise at all. You two fit together so perfectly that I knew it right from the first." Sam mumbled his felicitations, conscious of Tina's searching glances. "And now, if you'll excuse me, there's something I have to take care of immediately. A special sort of wedding present."

Lew was disconcerted. "A wedding present. This early?"

"Why certainly," Tina told him. "It isn't very easy to get just the right thing. And a special friend like Sam naturally wants to get a very special gift."

Sam decided he had taken enough. He grabbed the manual and his coat and dodged through the door.

By the time he came to the red stone steps of the boarding house, he had reached the conclusion that the wound, while painful, had definitely missed his heart. He was in fact chuckling at the memory of Lew Knight's face when his landlady plucked at his sleeve.

'That man was here again today, Mr. Weber. He said he wanted to see you."

"Which man? The tall, old fellow?"

Mrs. Lipanti nodded, her arms folded complacently across her chest. "Such an unpleasant person! When I told him you weren't in, he insisted I take him up to your room. I said I couldn't do that without your permission and he looked at me fit to kill. I've never believed in the evil eye myself—although I always say where there is smoke there must be fire—but if there is such a thing as an evil eye, he has it."

"Will he be back?"

"Yes. He asked me when you usually return and I said about eight o'clock, figuring that if you didn't want to meet him it would give you time to change your clothes and wash up and leave before he gets here. And, Mr. Weber, if you'll excuse me for saying this, I don't think you want to meet him."

"Thanks. But when he comes in at eight, show him up. If he's the right person, I'm in illegal possession of his property. I want to know where this property originates."

In his room, he put the manual away carefully and told the box to open. The Junior Biocalibrator was not too bulky and newspaper would suffice to cover it. He was on his way uptown in a few minutes with the strangely shaped parcel under his arm.

Did he still want to duplicate Tina, he pondered? Yes, in spite of everything. She was still the woman he desired more than any he had ever known; and with the original married to Lew, the replica would have no choice but himself. Only — the replica would have Tina's characteristics up to the moment the measurements were taken; she might insist on marrying Lew as well.

That would make for a bit of a sitcheeayshun. But he was still miles from that bridge. It might even be amusing—

The possibility of error was more annoying. The Tina he would make might be off-center in a number of ways: reds might overlap pinks like an imperfectly reproduced color photograph she might, in time, come to digest her own stomach; there could very easily be a streak of strange and incurable insanity implicit in his model which would not assert itself until a deep mutual affection had flowered and borne fruit. As yet, he was no great shakes as a twinner and human mimeographer; the errors he had made on Mrs. Lipanti's niece demonstrated his amateur standing.

Sam knew he would never be able to dismantle Tina if she proved defective. Outside of the chivalrous concepts and almost superstitious reverence for womankind pressed into him by a small town boyhood, there was the unmitigated horror he felt at the idea of such a beloved object going through the same disintegrating process as — well, the mannikin. But if he overlooked an essential in his construction, what other recourse would there be?

Solution: nothing must be overlooked. Sam grinned bitterly as the ancient elevator swayed up to his office. If he only had time for a little more practice with a person whose reactions he knew so exactly that any deviation from the norm would be instantly obvious! But the strange, old man would be calling tonight, and, if his business concerned "Bild-A-Man" sets, Sam's experiments might be abruptly curtailed. And where would he find such a person— he had few real friends and no intimate ones. And, to be at all valuable, it would have to be someone he knew as well as himself.

Himself!

"Floor, sir." The elevator oper-

ator was looking at him reproachfully. Sam's exultant shout had caused him to bring the carrier to a spasmodic stop six inches under the floor level, something he had not done since that bygone day when he had first nervously reached for the controls. He felt his craftmanship was under a shadow as he morosely closed the door behind the lawyer.

And why not himself? He knew his own physical attributes better than he knew Tina's; any mental instability on the part of his reproduced self would be readily discernible long before it reached the point of psychosis or worse. And the beauty of it was that he would have no compunction in disassembling a superfluous Sam Weber. Quite the contrary: the horror in that situation would be the continued existence of a duplicate personality; its removal would be a relief.

Twinning himself would provide the necessary practice in a familiar medium. Ideal. He'd have to take careful notes so that if anything went wrong he'd know just where to avoid going off the track in making his own personal Tina.

And maybe the old geezer wasn't interested in the set at all. Even if he were, Sam could take his landlady's advice and not be at home when he called. Silver linings wherever he looked.

Lew Knight stared at the instrument in Sam's hands. "What in the sacred name of Blackstone and all his commentaries is that? Looks like a lawn mower for a window box!"

"It's uh, sort of a measuring gadget. Gives the right size for one thing and another and this and that. Won't be able to get you the wedding present I have in mind unless I know the right sizes. Or sizes. Tina, would you mind stepping out into the hall?"

"Nooo." She looked dubiously at the gadget. "It won't hurt?"

It wouldn't hurt a bit, Sam assured her. "I just want to keep this a secret from Lew till after the ceremony."

She brightened at that and preceded Sam through the door. "Hey counselor," one of the other young lawyers called at Lew as they left. "Hey counselor, don't let him do that. Possession is nine points Sam always says. He'll never bring her back."

Lew chuckled weakly and bent over his work.

"Now I want you to go into the ladies' room," Sam explained to a bewildered Tina. "I'll stand guard outside and tell the other customers that the place is out of order. If another woman is inside wait until she leaves. Then strip."

"Strip?" Tina squealed.

He nodded. Then very carefully, emphasizing every significant detail of operation, he told her how to use the Junior Biocalibrator. How she must be careful to kick the switch and set the tape running. How she must cover every external square inch of her body. "This little arm will enable you to lower it down your back. No questions now. Git." She gat.

She was back in fifteen minutes,

fluffing her dress into place and studying the tape with a rapt frown. "This is the *strangest* thing— According to the spool, my iodine content—"

Sam snaffled the Biocalibrator hurriedly. "Don't give it another thought. It's a code, kind of. Tells me just what size and how many of what kind. You'll be crazy about the gift when you see it."

"I know I will." She bent over him as he kneeled and examined the tape to make certain she had applied the instrument correctly. "You know, Sam, I always felt your taste was perfect. I want you to come and visit us often after we're married. You can have such beautiful ideas! Lew is a bit too . . . too businesslike, isn't he? I mean it's necessary for success and all that, but success isn't everything. I mean you have to have culture, too. You'll help me keep cultured, won't you, Sam?"

"Sure," Sam said vaguely. The tape was complete. Now to get started! "Anything I can do—glad to help."

He rang for the elevator and noticed the forlorn uncertainty with which she watched him. "Don't worry, Tina. You and Lew will be very happy together. And you'll love this wedding present." But not as much as I will, he told himself as he stepped into the elevator.

Back in his room, he emptied the machine and undressed. In a few moments he had another tape on himself. He would have liked to consider it for a while, but being this close to the goal made him impatient. He locked the door, cleaned his room hurriedly of accumulated junk—remembering to sniff in annoyance at Aunt Maggie's ties: the blue and red one almost lighted up the room—ordered the box to open —and he was ready to begin.

First the water. With the huge amount of water necessary to the human body, especially in the case of an adult, he might as well start collecting it now. He had bought several pans and it would take his lone faucet some time to fill them all.

As he placed the first pot under the tap, Sam wondered suddenly if its chemical impurities might affect the end product. Of course it might! These children of 2153 would probably take absolutely pure H_2O as a matter of daily use; the manual hadn't mentioned the subject, but how did he know what kind of water they had available? Well, he'd boil this batch over his chemical stove; when he got to making Tina he could see about getting *aqua* completely *pura*.

Score another point for making a simulacrum of Sam first.

While waiting for the water to boil, he arranged his supplies to positions of maximum availability. They were getting low. That baby had taken up quite a bit of useful ingredients; too bad he hadn't seen his way clear to disassembling it. That meant if there were any argument in favor of allowing the replica of himself to go on living, it was now invalid. He'd have to take it apart in order to have enough for Tina II. Or Tina prime?

He leafed through Chapters VI, VII and VIII on the ingredients, completion and disassembling of a man. He'd been through this several times before but he'd passed more than one law exam on the strength of a last-minute review.

The constant reference to mental instability disturbed him. "The humans constructed with this set will, at the very best, show most of the superstitious tendencies, and neurosis-compulsions of medieval mankind. In the long run they are not normal; take great care not to consider them such." Well, it wouldn't make too much difference in Tina's case—and that was all that was important.

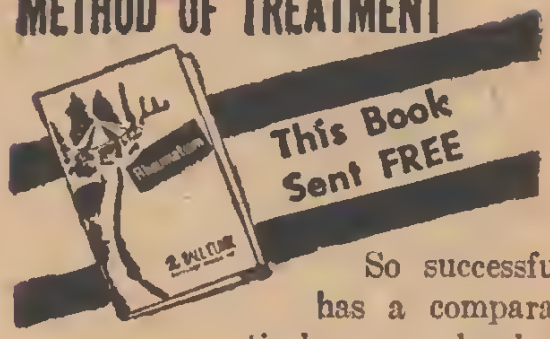
When he had finished adjusting the molds to the correct sizes, he fastened the vitalizer to the bed. Then—very, very slowly and with repeated glances at the manual, he began to duplicate Sam Weber. He learned more of his physical limitations and capabilities in the next two hours than any man had ever known since the day when an inconspicuous primate had investigated the possibilities of ground locomotion upon the nether extremities alone.

Strangely enough, he felt neither awe nor exultation. It was like building a radio receiver for the first time. Child's play.

Most of the vials and jars were empty when he had finished. The damp molds were stacked inside the box, still in their three-dimensional outline. The manual lay neglected on the floor.

Sam Weber stood near the bed looking down at Sam Weber on the bed.

RHEUMATISM YIELDS to MODERN REVOLUTIONARY METHOD OF TREATMENT



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All that remained was vitalizing. He daren't wait too long or imperfections might set in and the errors of the baby be repeated. He shook off a nauseating feeling of unreality, made certain that the big disassembleator was within reach and set the Jiffy Vitalizer in motion.

The man on the bed coughed. He stirred. He sat up.

"Wow!" he said. "Pretty good, if I do say so myself!"

And then he had leaped off the bed and seized the disassembleator. He tore great chunks of wiring out of the center, threw it to the floor and kicked it into shapelessness. "No Sword of Damocles going to hang over *my* head," he informed an open-mouthed Sam Weber. "Although, I could have used it on you, come to think of it."

Sam eased himself to the mattress and sat down. His mind stopped rearing and whinnied to a halt. He had been so impressed with the helplessness of the baby and the mannikin that he had never dreamed of the possibility that his duplicate would enter upon life with such enthusiasm. He should have, though; this was a full-grown man, created at a moment of complete physical and mental activity.

"This is bad," he said at last in a hoarse voice. "You're unstable. You can't be admitted into normal society."

"I'm unstable" his image asked. "Look who's talking! The guy who's been mooning his way through his adult life, who wants to marry an overdressed, conceited collection of biological impulses that would come crawling on her knees to any man sensible enough to push the right buttons—"

"You leave Tina's name out of this," Sam told him, feeling acutely uncomfortable at the theatrical phrase.

His double looked at him and grinned. "O.K., I will. But not her body! Now, look here, Sam or Weber or whatever you want me to call you, you can live your life and I'll live mine. I won't even be a lawyer if that'll make you happy. But as far as Tina is concerned, now that there are no ingredients to make a copy — that was a rotten escapist idea, by the way—I have enough of your likes and dislikes to want her badly. And I can have her, whereas you can't. You don't have the gumption."

Sam leaped to his feet and doubled his fists. Then he saw the other's entirely equal size and slightly more assured twinkle. There was no point in fighting — that would end in a draw, at best. He went back to reason.

"According to the manual," he began, "you are prone to neurosis—"

"The manual! The manual was written for children of two centuries hence, with quite a bit of selective breeding and scientific education behind them. Personally, I think I'm a—"

There was a double knock on the door. "Mr. Weber."

"Yes," they both said simultaneously.

Outside, the landlady gasped and began speaking in an uncertain voice.

"Th-that gentleman is downstairs. He'd like to see you. Shall I tell him you're in?"

"No, I'm not at home," said the double.

"Tell him I left an hour ago," said Sam at exactly the same moment.

There was another, longer gasp and the sound of footsteps receding hurriedly.

"That's one clever way to handle a situation," Sam's facsimile exploded. "Couldn't you keep your mouth shut? The poor woman's probably gone off to have a fit."

"You forget that this is my room and you are just an experiment that went wrong," Sam told him hotly. "I have just as much right, in fact more right . . . hey, what do you think you're doing?"

The other had thrown open the closet door and was stepping into a pair of pants. "Just getting dressed. You can wander around in the nude if you find it exciting, but I want to look a bit respectable."

"I undressed to take my measurements . . . or your measurements. Those are my clothes, this is my room—"

"Look, take it easy. You could never prove it in a court of law. Don't make me go into that *cliché* about what's yours is mine and so forth."

Heavy feet resounded through the hall. They stopped outside the room. Cymbals seemed to clash all around them and there was a panic-stricken sense of unendurable heat. Then shrill echoes fled into the distance. The walls stopped shuddering.

Silence and a smell of burning wood.

They whirled in time to see a terribly tall, terribly old man in a long black overcoat walking through the smoldering remains of the door. Much too tall for the entrance, he did not stoop at he came in; rather, he drew his head down into his garment and shot it up again. Instinctively, they moved closed together.

His eyes, all shiny black iris without any whites, were set back deep in the shadow of his head. They reminded Sam Weber of the scanners on the Biocalibrator: they tabulated, deduced, rather than saw.

"I was afraid I would be too late," he rumbled at last in weird, clipped tones. "You have already duplicated yourself, Mr. Weber, making necessary unpleasant rearrangements. And the duplicate has destroyed the disassembleator. Too bad. I shall have to do it manually. An ugly job."

He came further into the room until they could almost breathe their fright upon him. "This affair has already dislocated four major programs, but we had to move in accepted cultural grooves and be absolutely certain of the recipient's identity before we could act to withdraw the set. Mrs. Lipanti's collapse naturally stimulated emergency measures."

The duplicate cleared his throat. "You are—?"

"Not exactly human. A humble civil servant of precision manufacture. I am Census Keeper for the entire twenty-ninth oblong. You see, your set was intended for the Thregander children who are on a

field trip in this oblong. One of the Threganders who has a Weber chart requested the set through the chrondromos which, in an attempt at the supernormal, unstabled without carnuplicating. You therefore received the package instead. Unfortunately, the unstabling was so complete that we were forced to locate you by indirect methods."

The Census Keeper paused and Sam's double hitched his pants nervously. Sam wished he had anything —even a fig leaf—to cover his nakedness. He felt like a character in the Garden of Eden trying to build up a logical case for apple eating. He appreciated glumly how much more than "Bild-A-Man" sets clothes had to do with the making of a man.

"We will have to recover the set, of course," the staccato thunder continued, "and readjust any discrepancies it has caused. Once the matter has been cleared up, however, your life will be allowed to resume its normal progression. Meanwhile, the problem is which of you is the original Sam Weber?"

"I am," they both quavered—and turned to glare at each other.

"Difficulties," the old man rumbled. He sighed like an arctic wind. "I always have difficulties! Why can't I ever have a simple case like a carnuplicator?"

"Look here," the duplicate began. "The original will be—"

"Less unstable and of better emotional balance than the replica," Sam interrupted. "Now, it seems—"

"That you should be able to tell the difference," the other concluded breathlessly. "From what you see and have seen of us, can't you decide which is the more valid member of society?"

What a pathetic confidence, Sam thought, the fellow was trying to display! Didn't he know he was up against someone who could really discern mental differences? This was no fumbling psychiatrist of the present; here was a creature who could see through externals to the most coherent personality beneath.

"I can, naturally. Now, just a moment." He studied them carefully, his eyes traveling with judicious leisure up and down their bodies. They waited, fidgeting, in a silence that pounded.

"Yes," the old man said at last. "Yes. Quite."

He walked forward.

A long thin arm shot out.

He started to disassemble Sam Weber.

"But listennnnn—" began Weber in a yell that turned into a high scream and died in a liquid mumble.

"It would be better for your sanity if you didn't watch," the Census Keeper suggested.

The duplicate exhaled slowly, turned away and began to button a shirt. Behind him the mumbling continued, rising and falling in pitch.

"You see," came the clipped, rumbling accents, "it's not the gift we're afraid of letting you have—it's the principle involved. Your civilization isn't ready for it. You understand."

"Perfectly," replied the counterfeit Weber, knotting Aunt Maggie's blue and red tie.

THE END.

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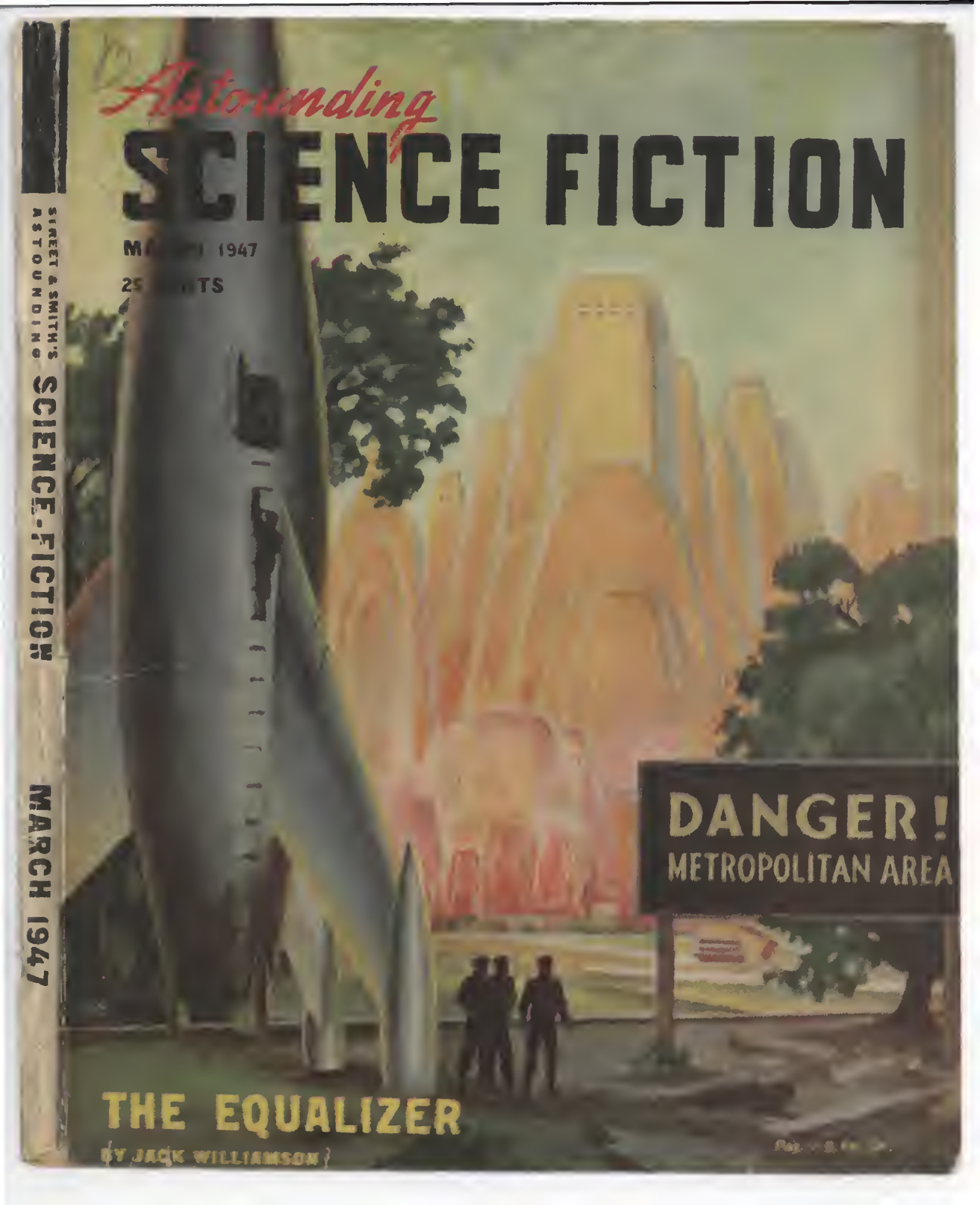
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